The Cerebral Cortex
and
Higher Intellectual Functions

Allocortex

Neocortex

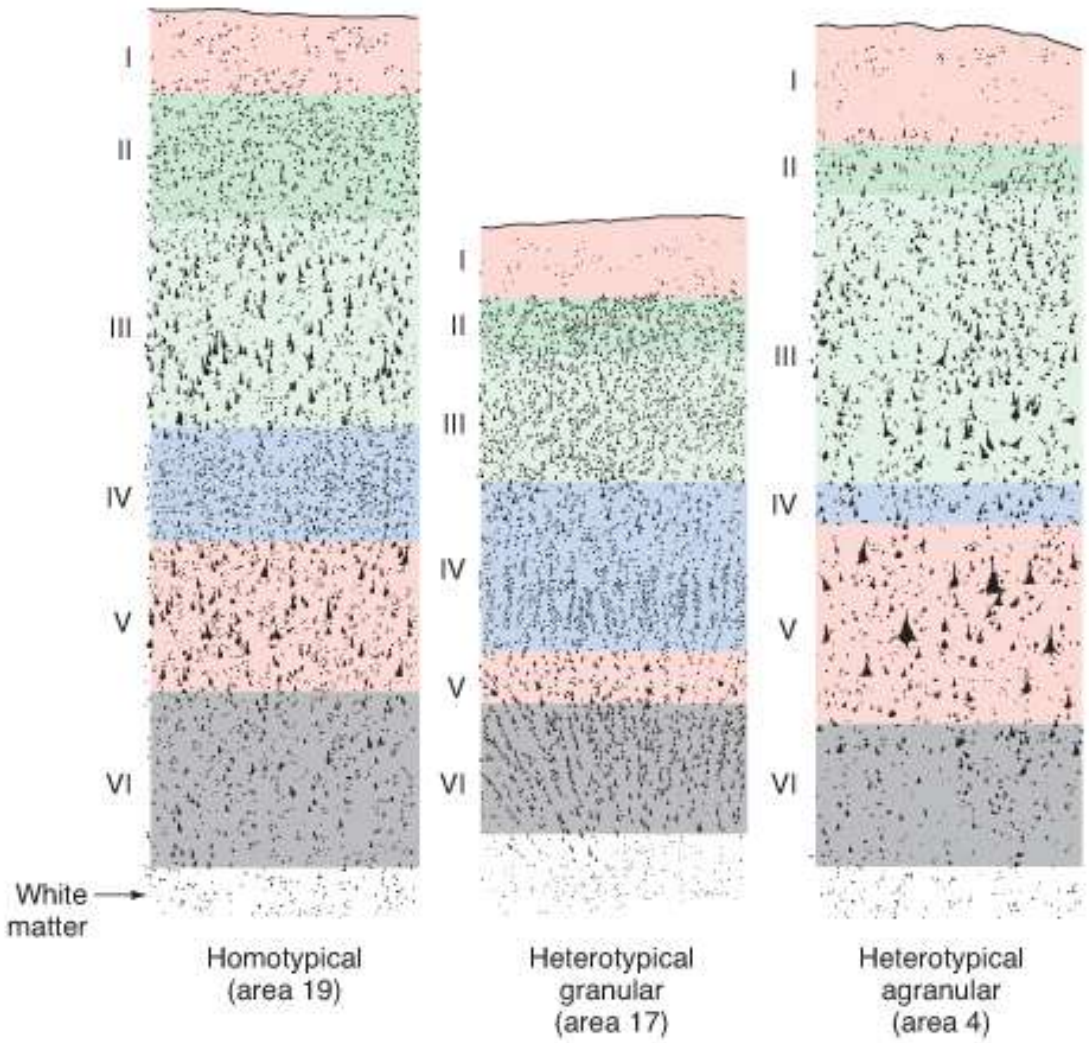
Allocortex

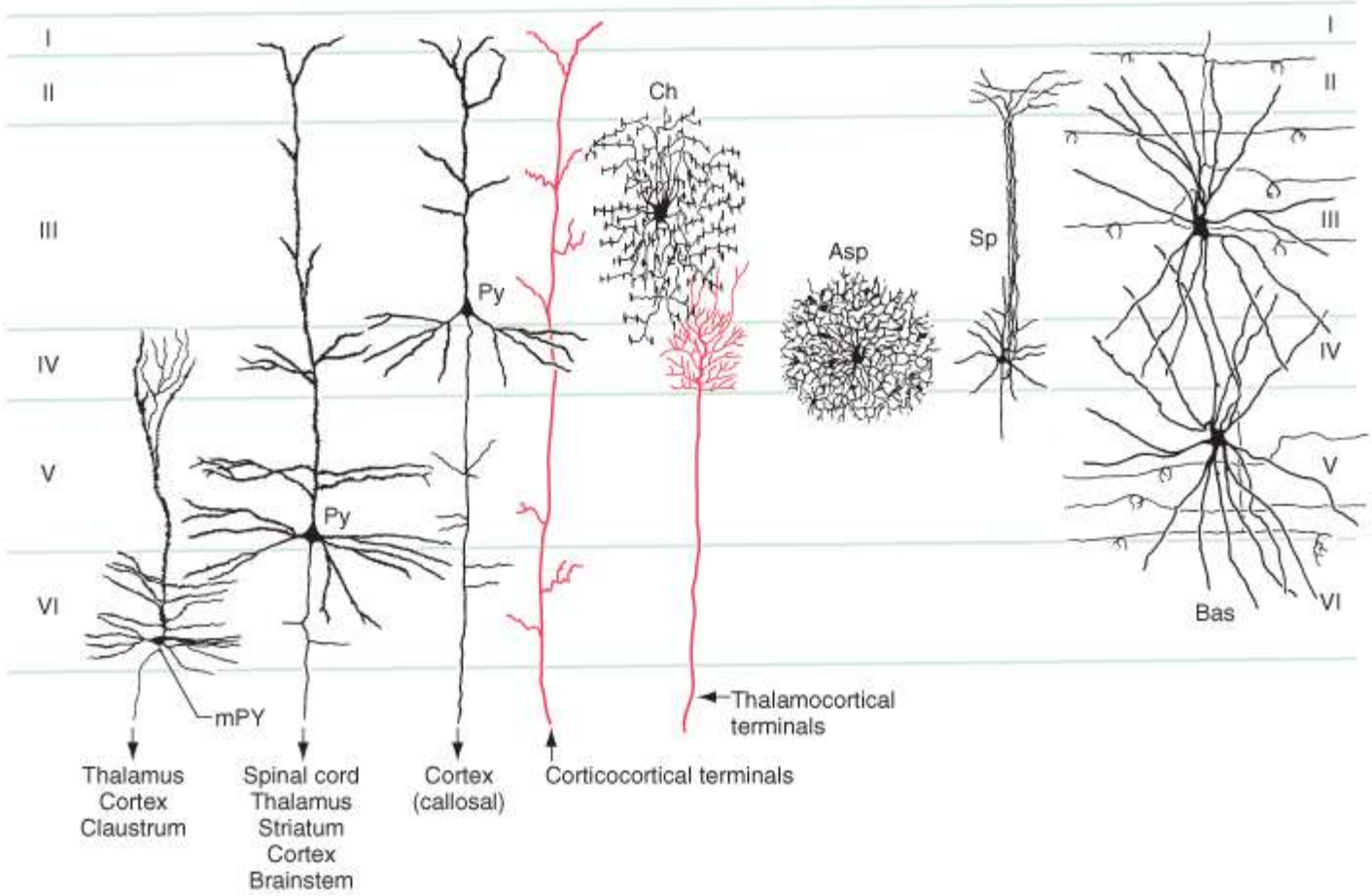
Periallocortex

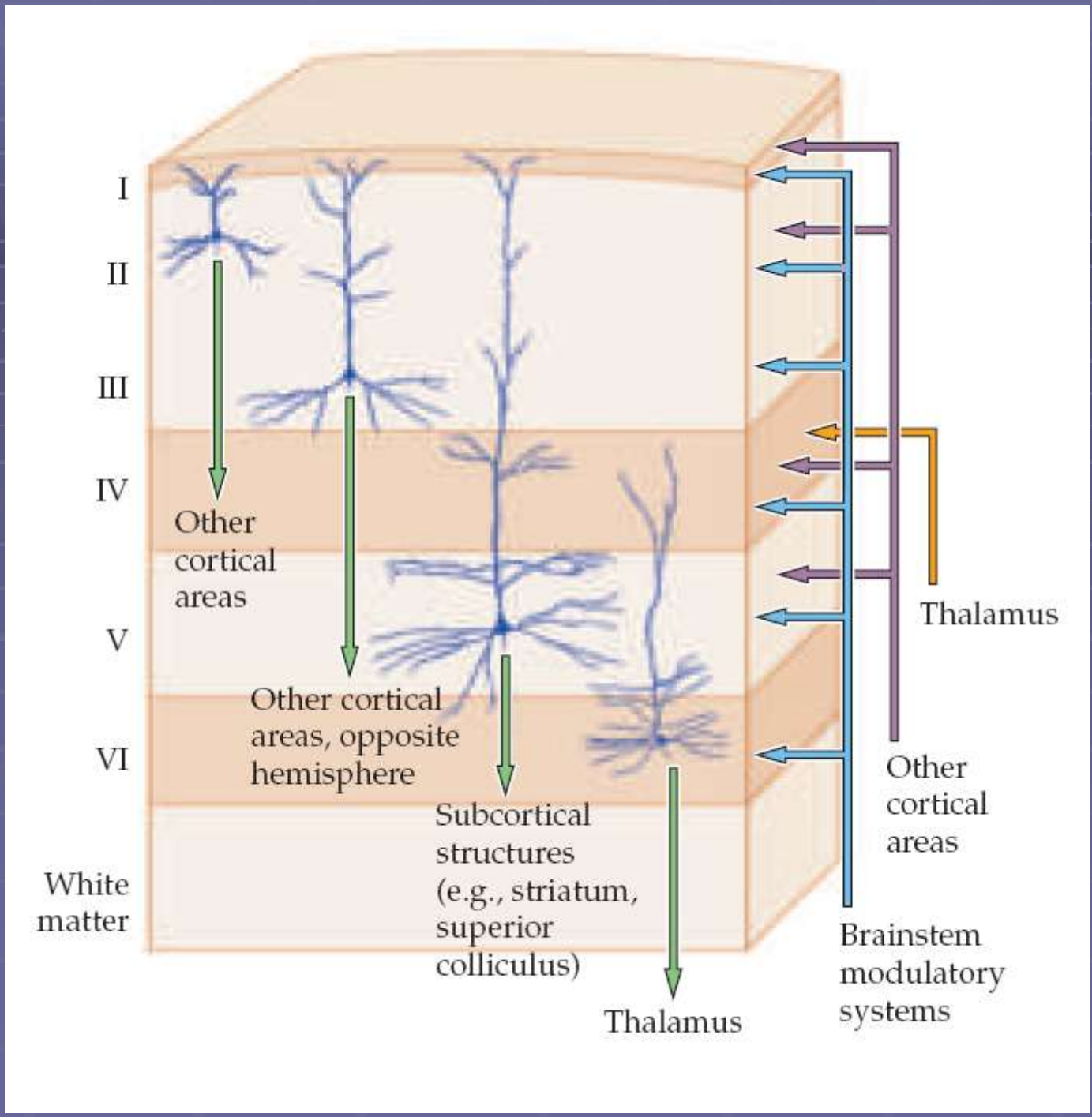
Paleocortex

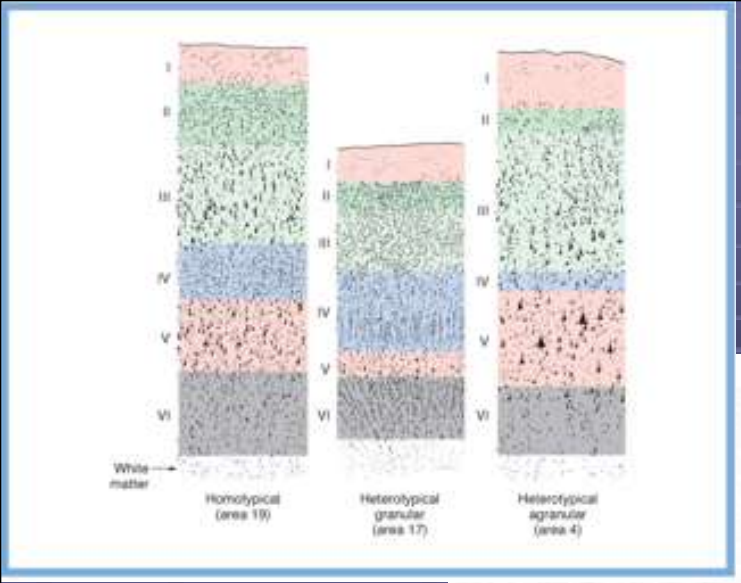
- .

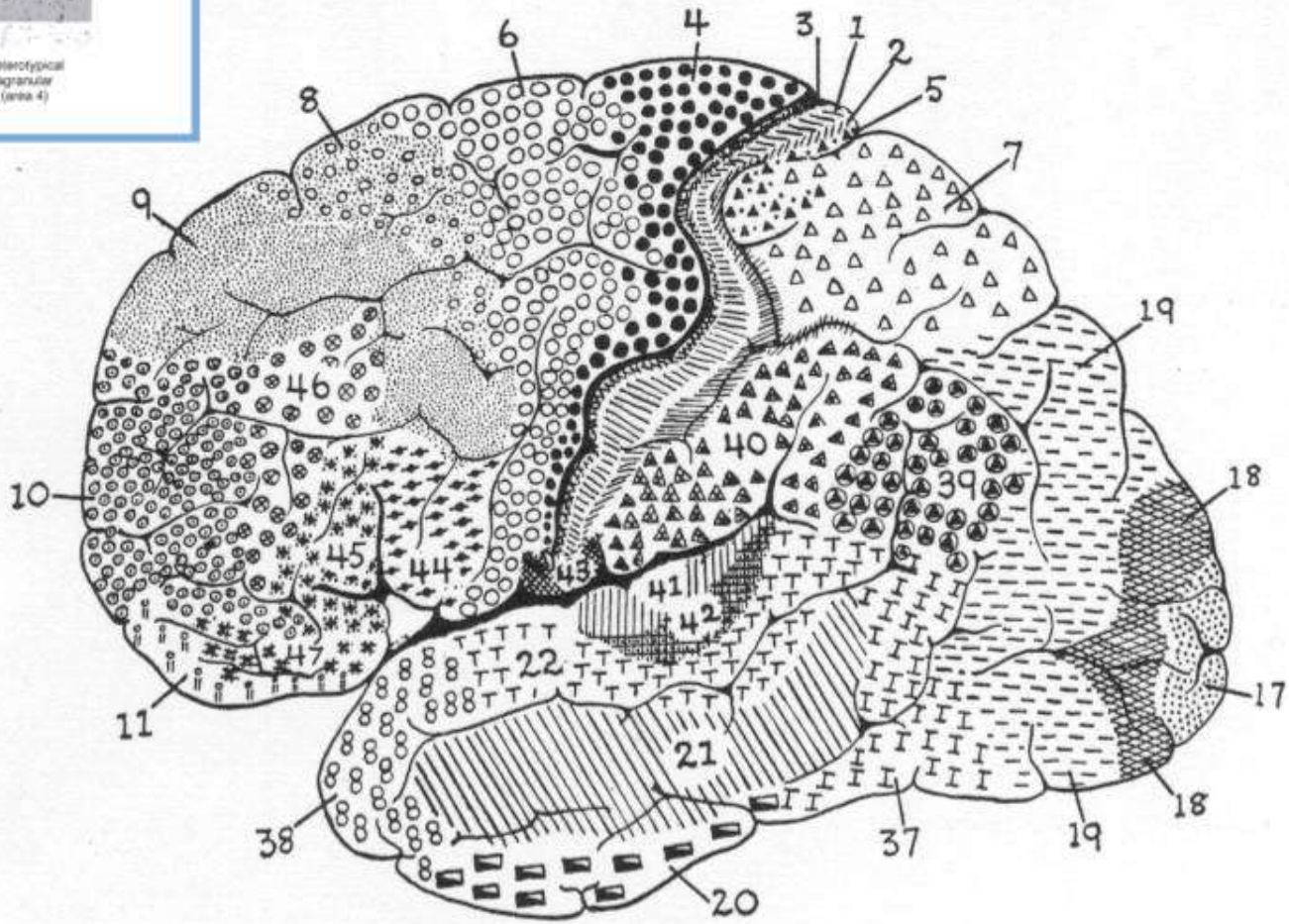
Archicortex


I
II
III
IV
V
VI
White matter
Homotypical (area 19)
Heterotypical granular (area 17)
Heterotypical agranular (area 4)


I
II
III
IV
V
VI
Ch
Py
Py
Asp
Sp
mPY
Thalamocortical terminals
Corticocortical terminals
Thalamus
Cortex
Claustrum
Spinal cord
Thalamus
Striatum
Cortex
Brainstem
Cortex
(callosal)
Bas


I
II
III
IV
V
VI
White matter
Other cortical areas
Other cortical areas, opposite hemisphere
Subcortical structures (e.g., striatum, superior colliculus)
Thalamus
Thalamus
Other cortical areas
Brainstem modulatory systems


I
II
III
IV
V
VI
White matter
Homotypical (area 19)
Heterotypical granular (area 17)
Heterotypical agranular (area 4)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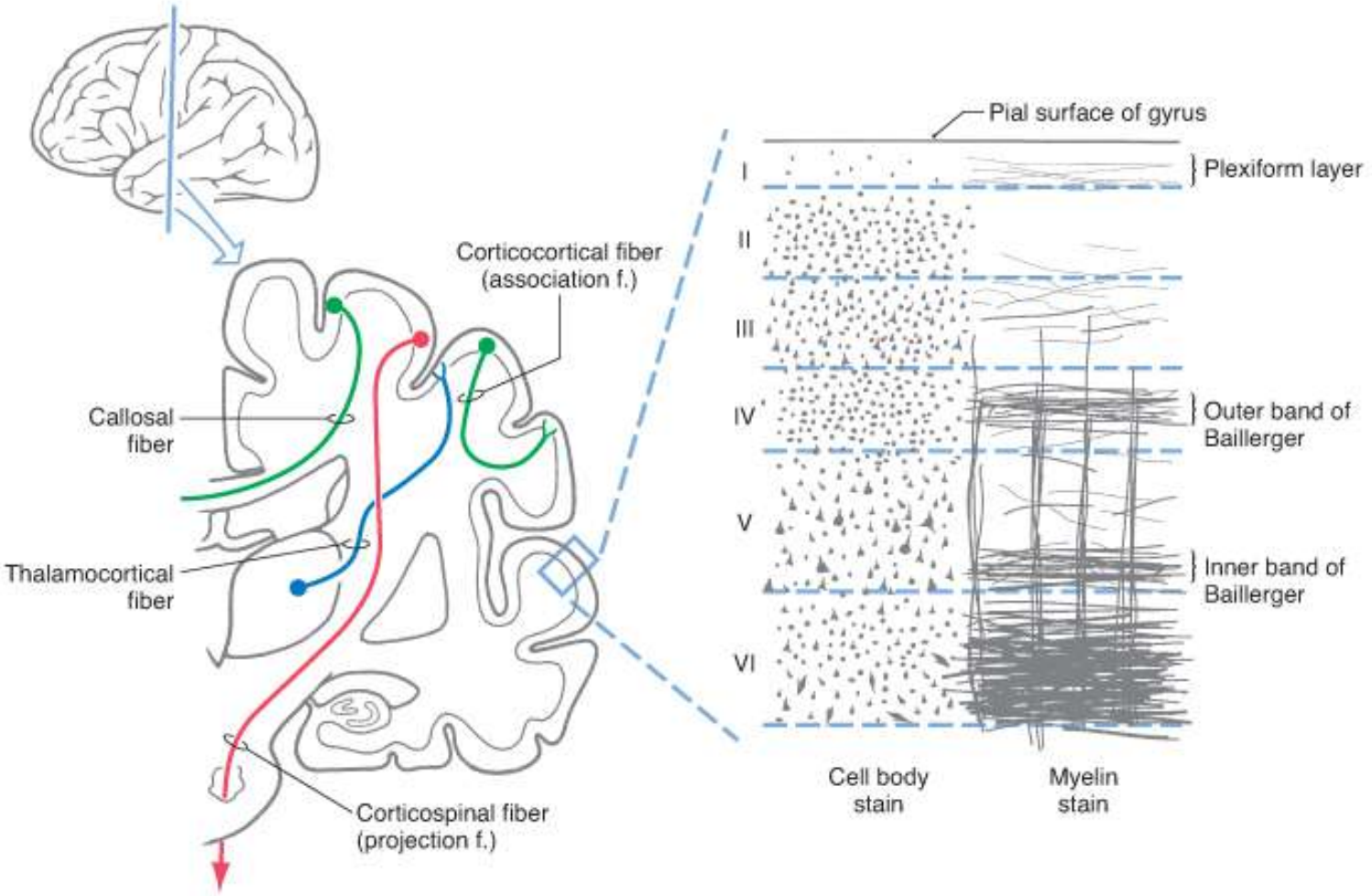
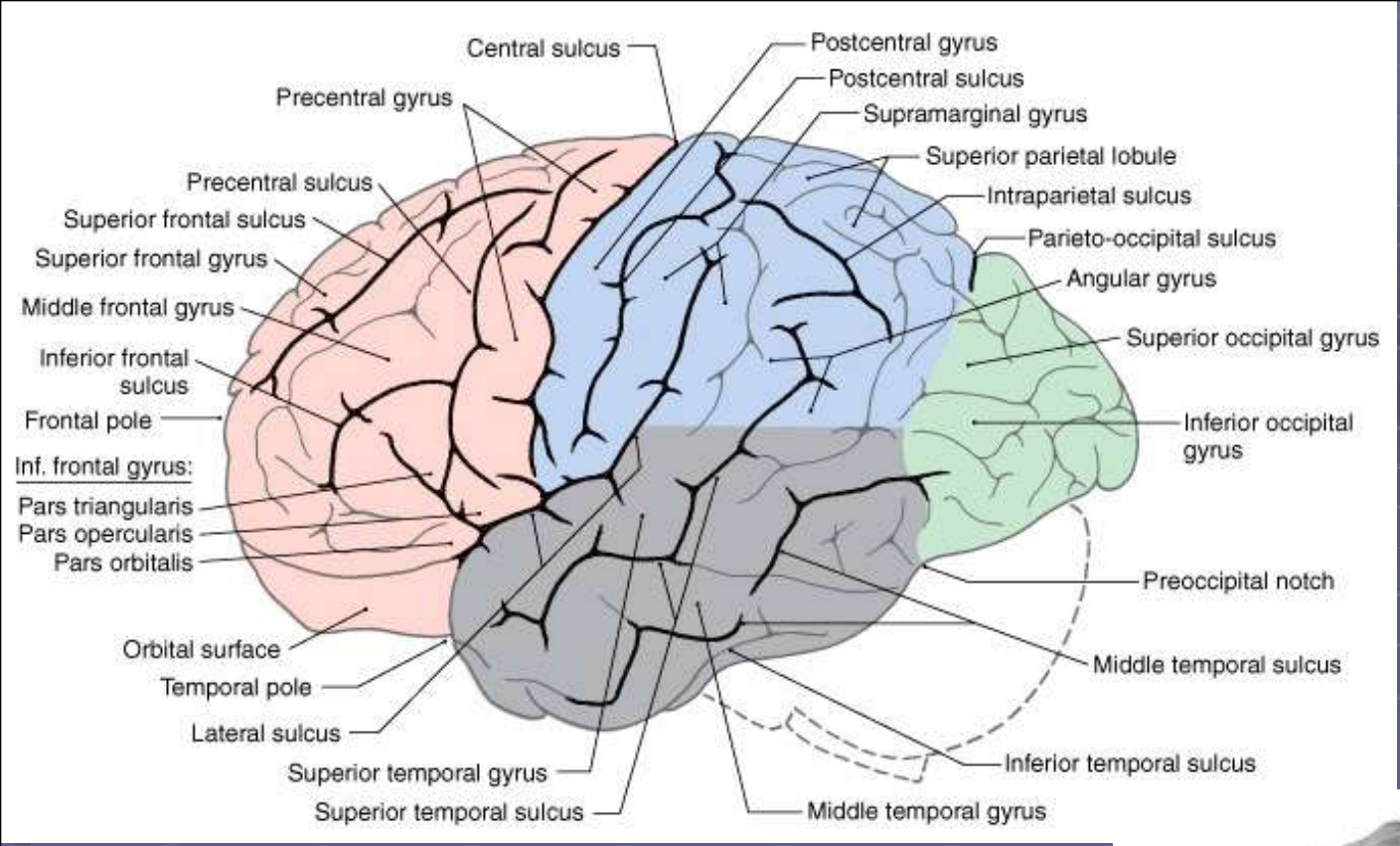
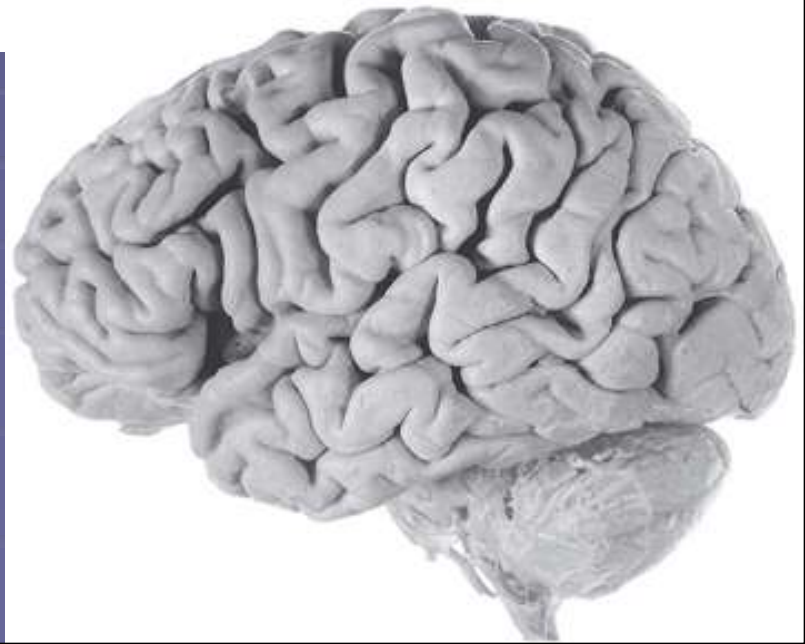

Corticocortical fiber
(association f.)
Callosal
fiber
Thalamocortical
fiber
Corticospinal fiber
(projection f.)
Pial surface of gyrus
I
II
III
IV
V
VI
Plexiform layer
Outer band of
Baillerger
Inner band of
Baillerger
Cell body
stain
Myelin
stain

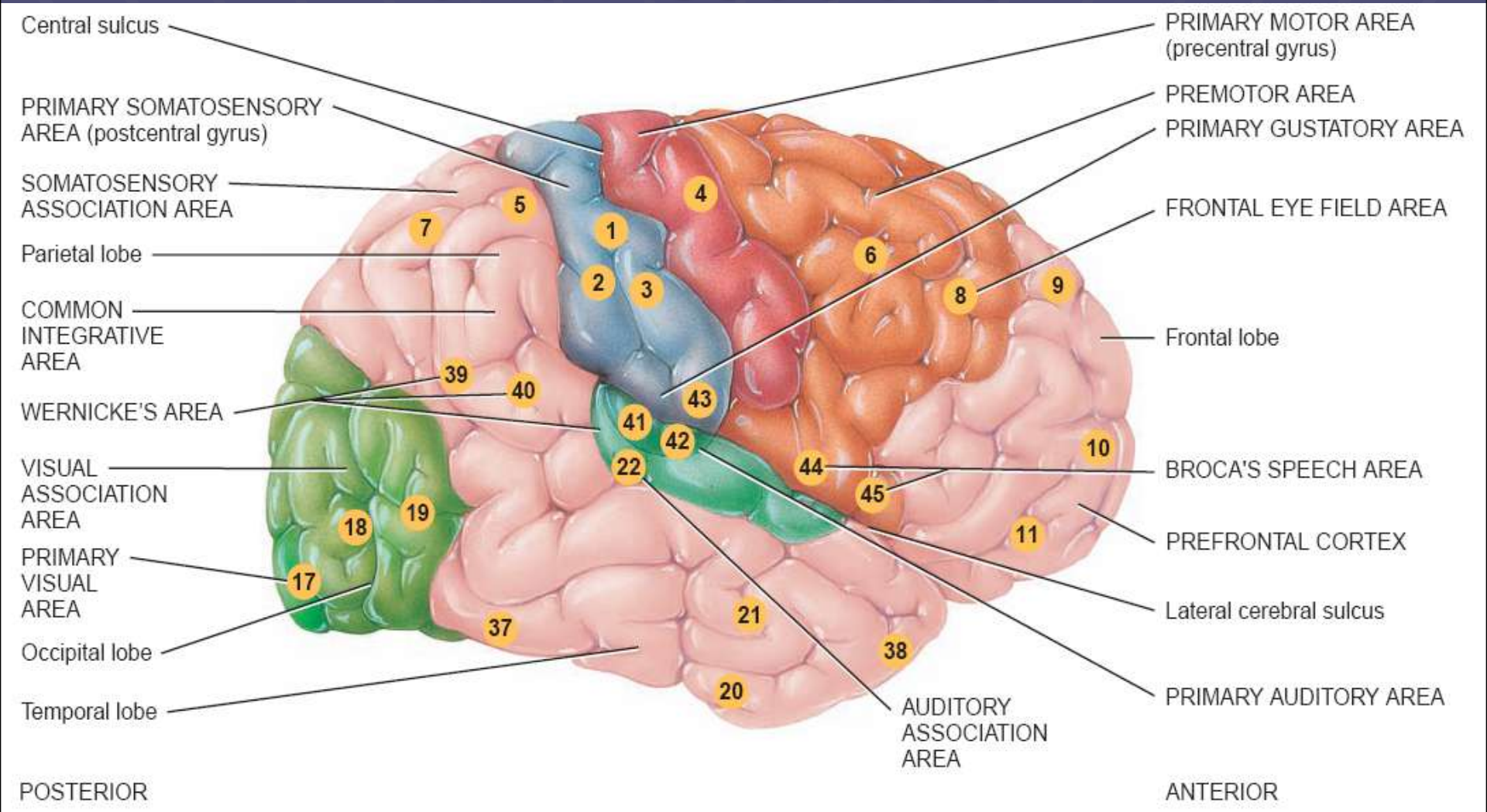


Lobes in a lateral view of left hemisphere



The Insula
The Hidden Lobe

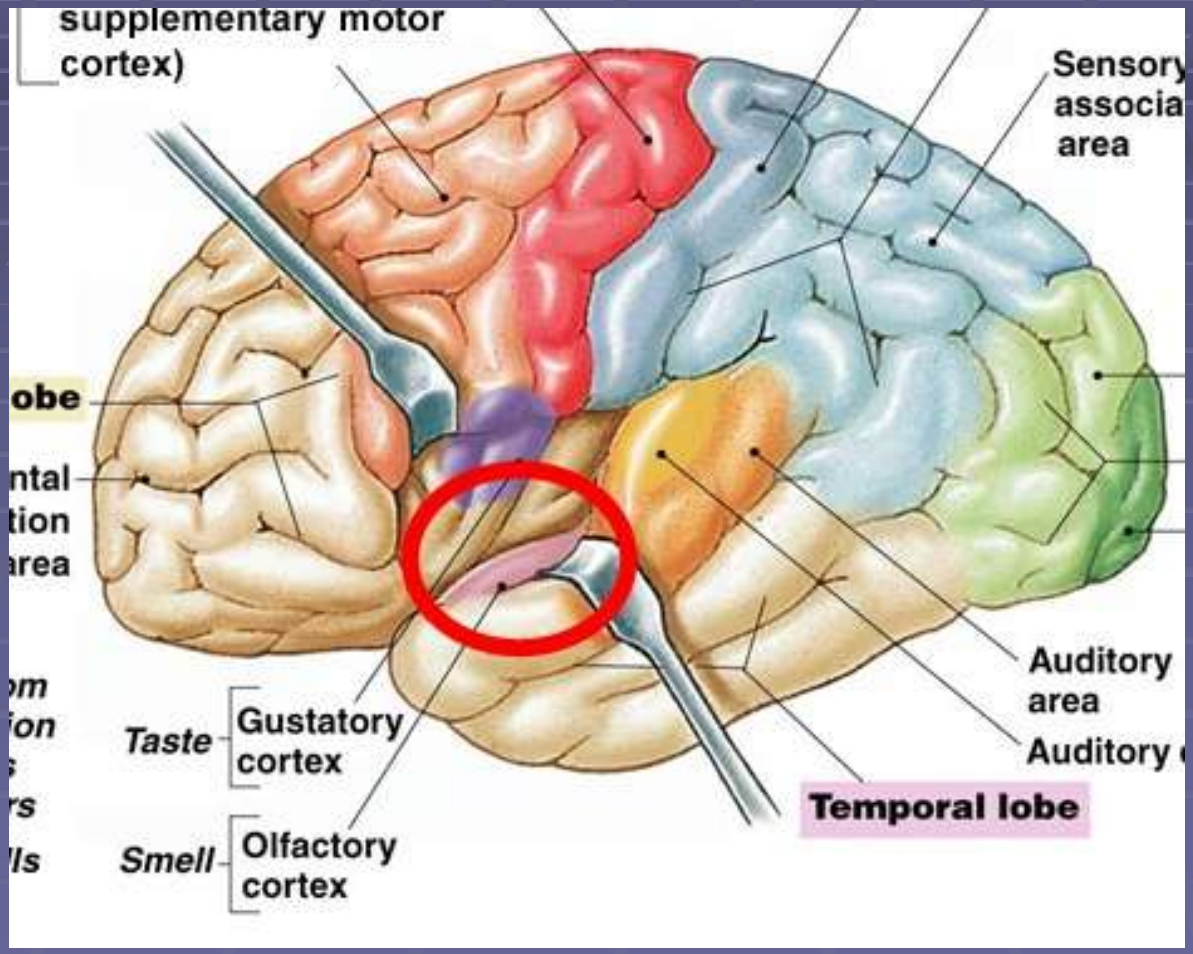
Primary, Secondary and Association



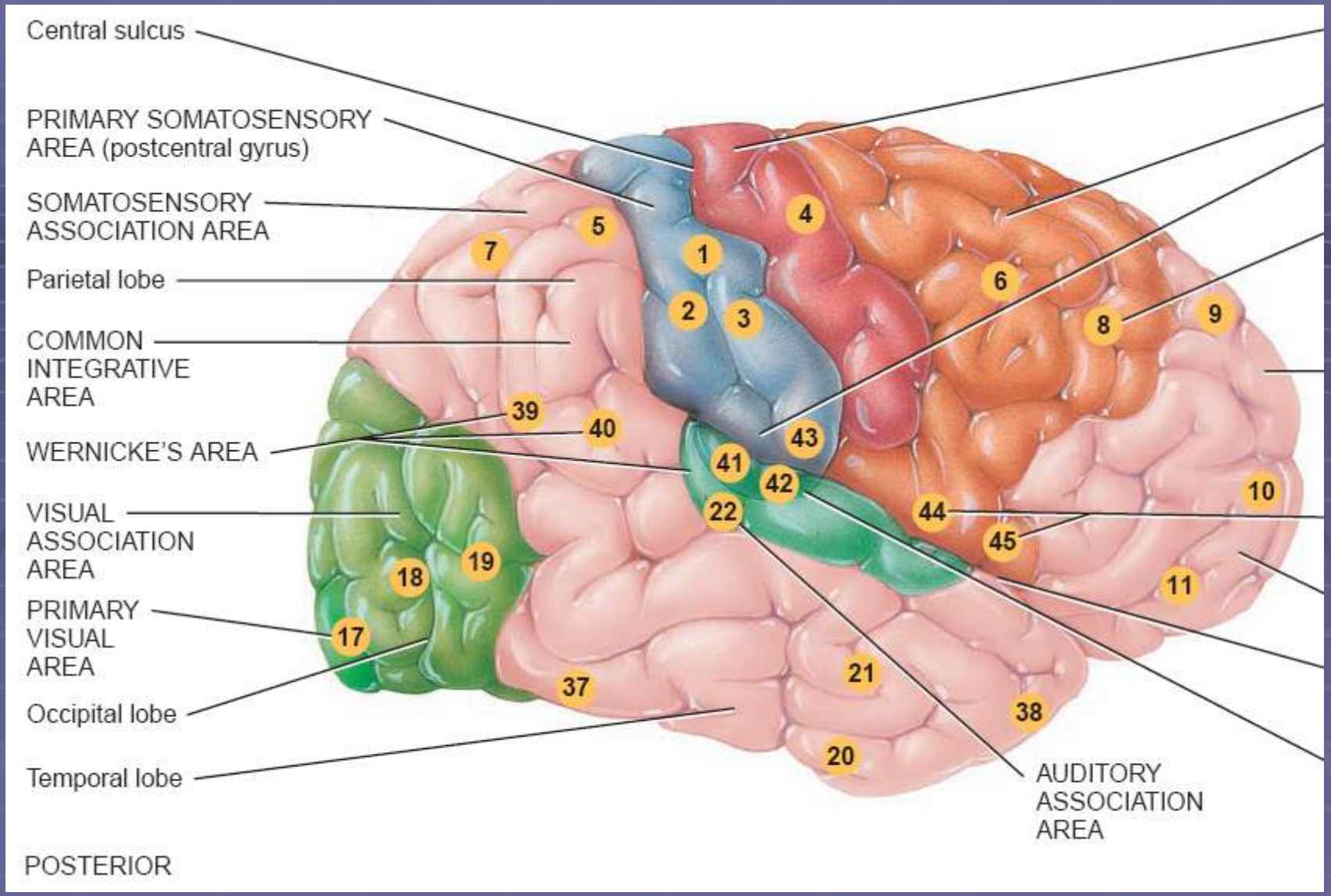
Lateral view of right cerebral hemisphere

Agnosia and Apraxia

Olfactory cortex

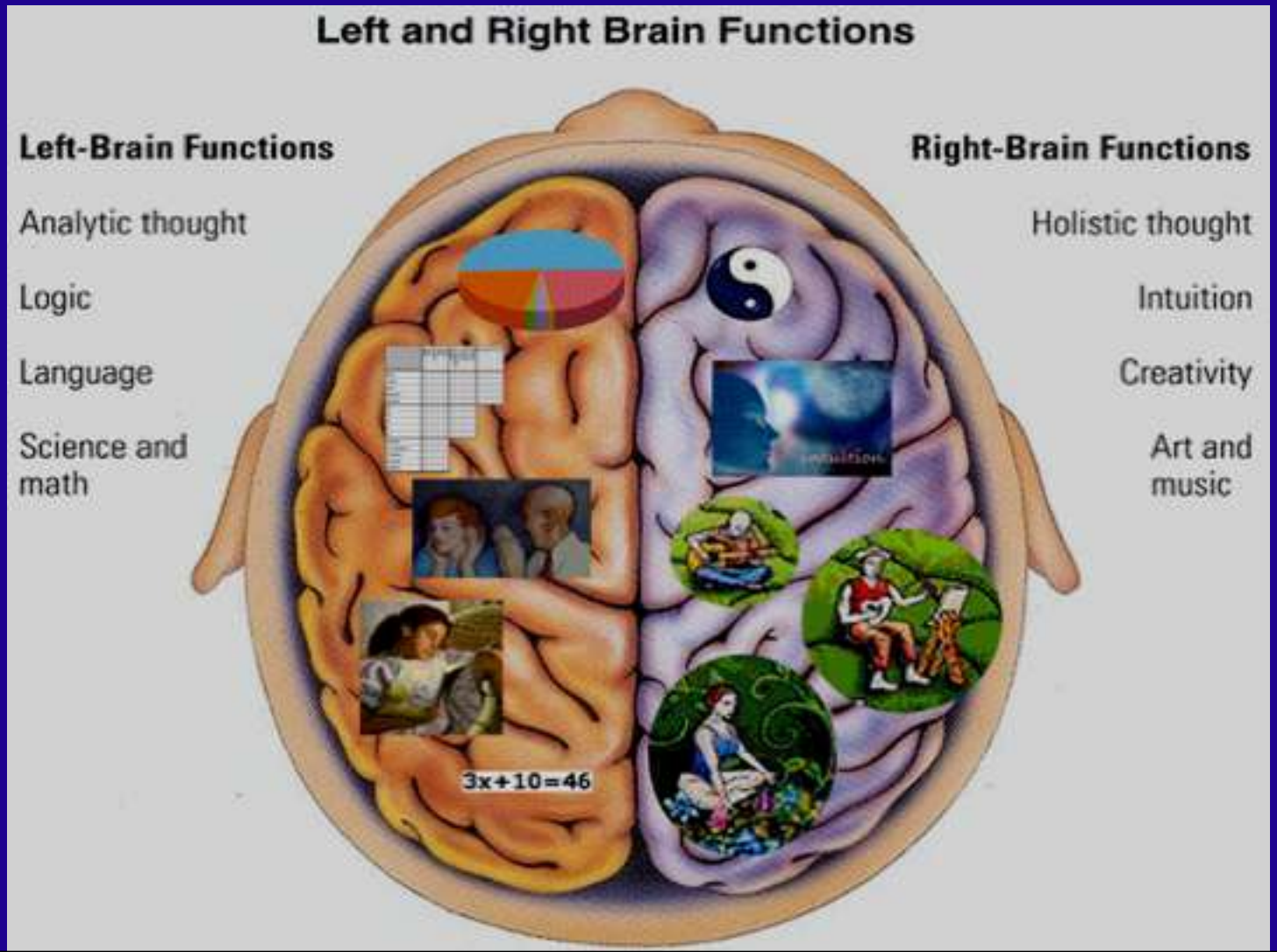


- Inferior and medial surface of temporal lobe



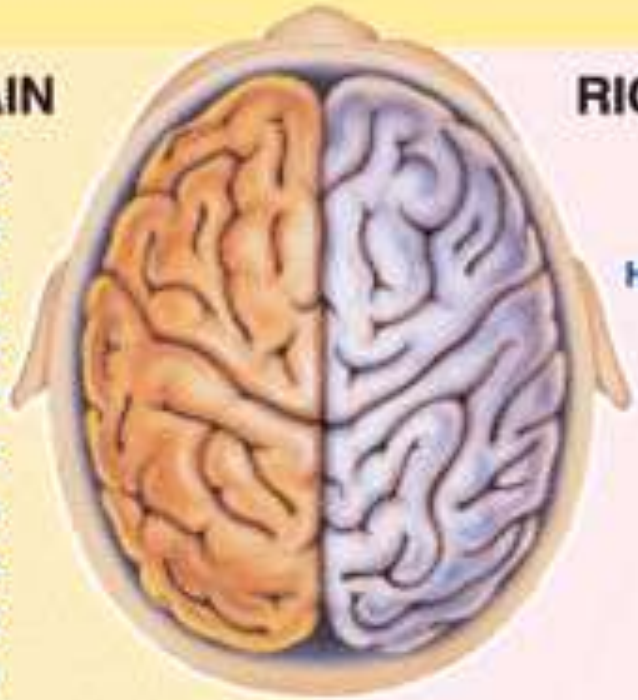
- Orbitofrontal cortex : one of olfactory association cortex.
  - Odors identification (right side)

Brain and higher cortical functions



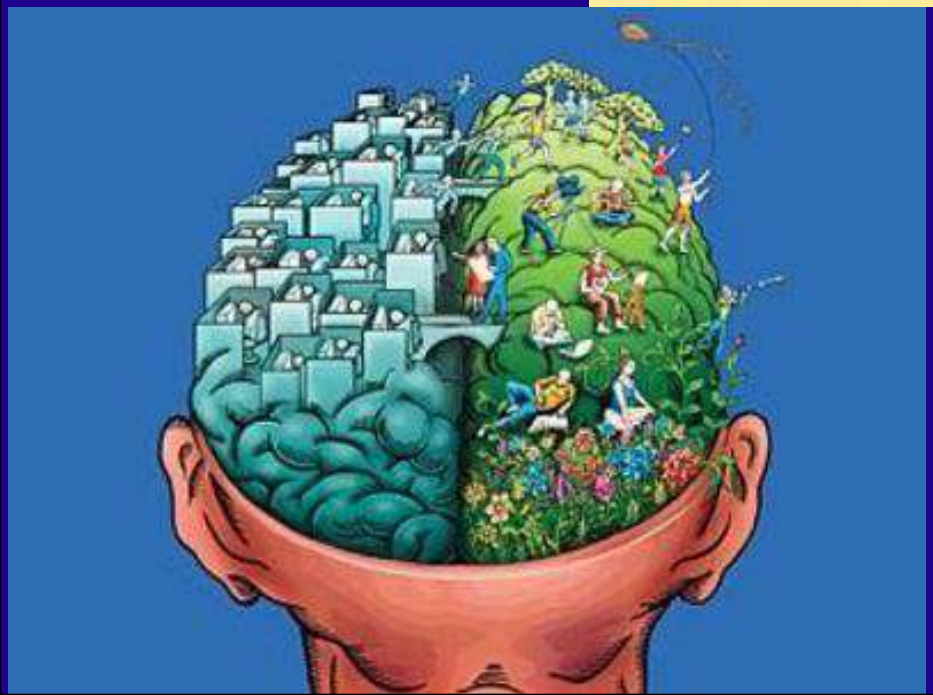
LEFT BRAIN

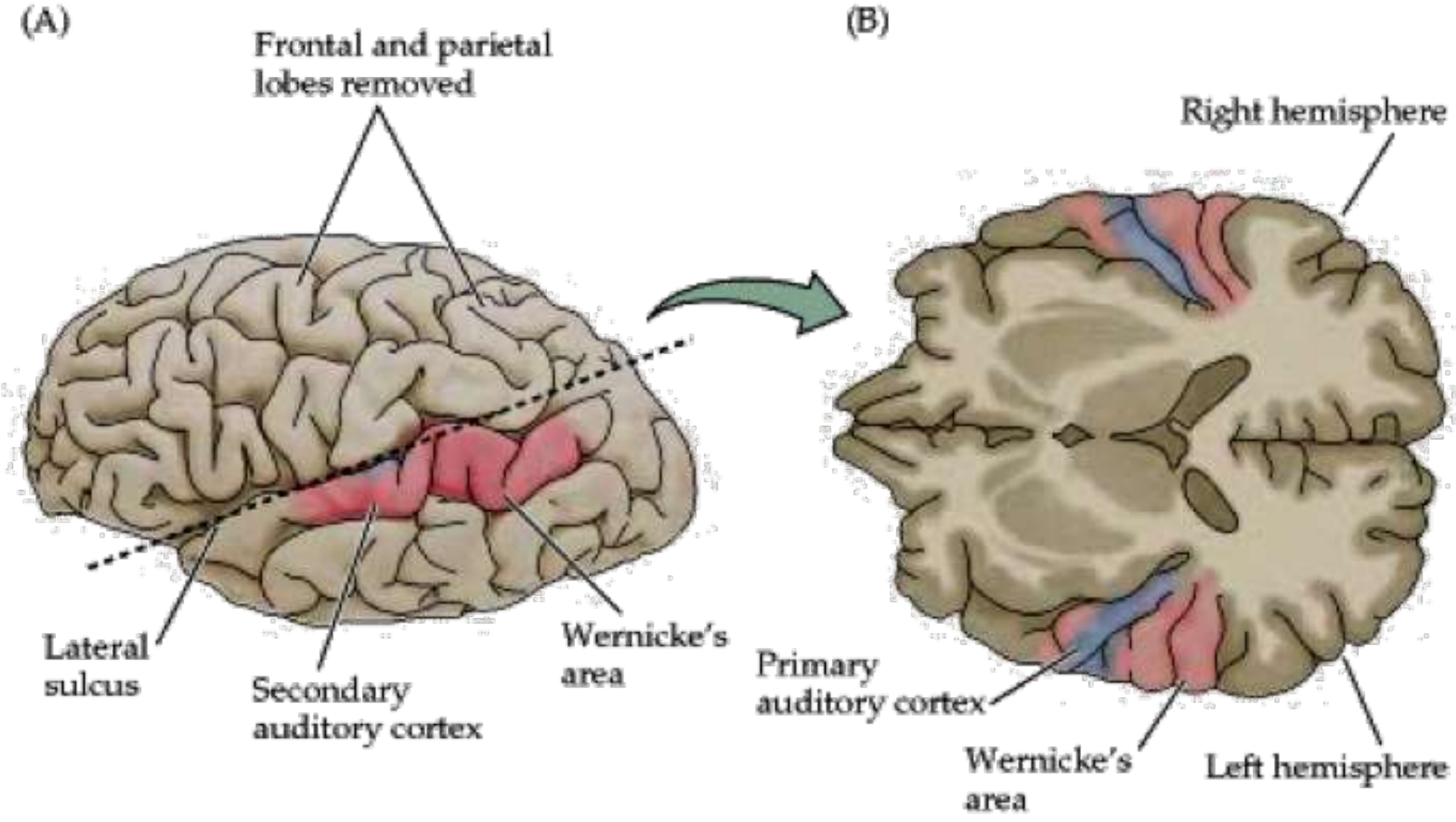
LOGIC
ANALYSIS
SEQUENCING
LINEAR
MATHEMATICS
LANGUAGE
FACTS
THINK IN WORDS
WORDS OF SONGS
COMPUTATION

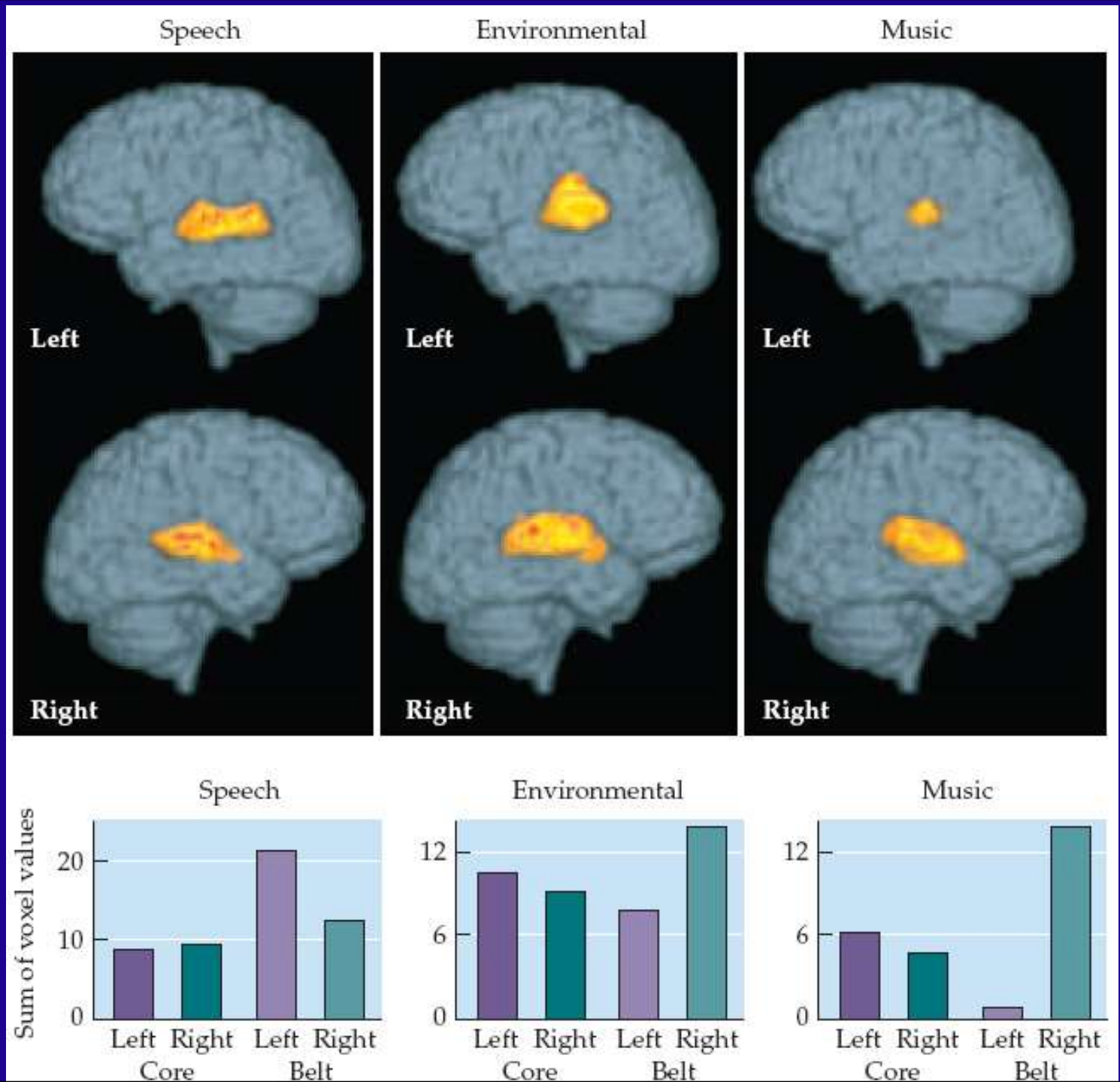


RIGHT BRAIN

CREATIVITY
IMAGINATION
HOLISTIC THINKING
INTUITION
ARTS (Motor skill)
RHYTHM (Beats)
NON-VERBAL
FEELINGS
VISUALISATION
TUNE OF SONGS
DAYDREAMING

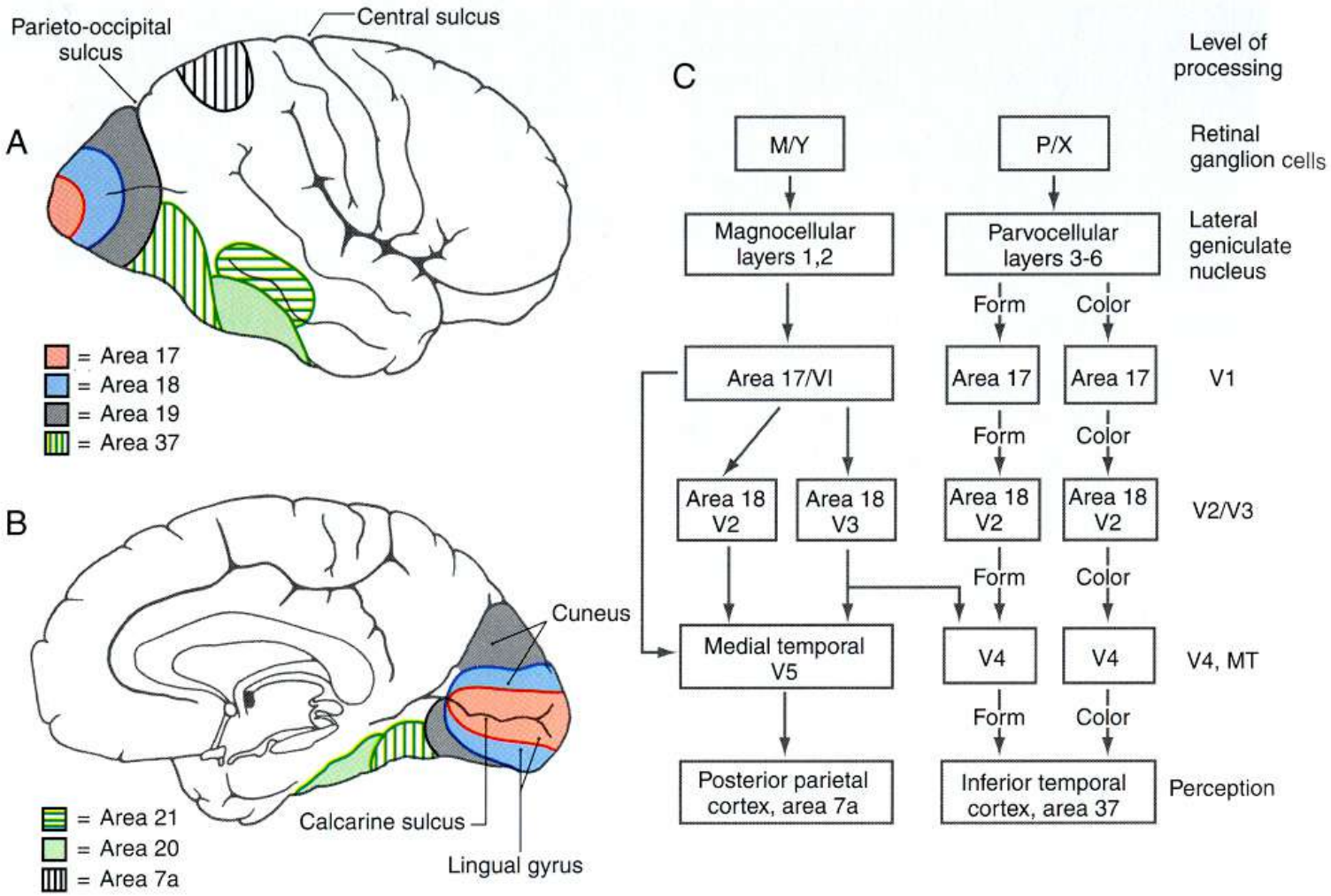



(A)
Frontal and parietal lobes removed
Lateral sulcus
Secondary auditory cortex
Wernicke's area
(B)
Right hemisphere
Primary auditory cortex
Wernicke's area
Left hemisphere

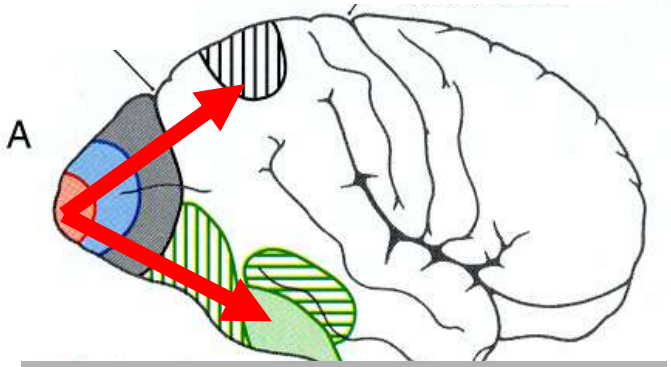

Speech
Environmental
Music
Left
Right
Left
Right
Left
Right
Speech
Environmental
Music
Sum of voxel values
20
10
0
12
6
0
12
6
0
Left Right Left Right
Core Belt
Left Right Left Right
Core Belt
Left Right Left Right
Core Belt

Cortical processing

- Parallel
- Continues

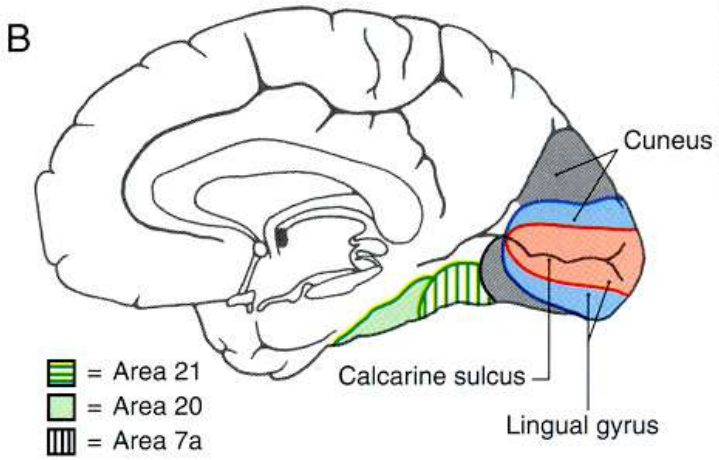

A
Parieto-occipital sulcus
Central sulcus
= Area 17
= Area 18
= Area 19
= Area 37
B
Cuneus
= Area 21
= Area 20
= Area 7a
Calcarine sulcus
Lingual gyrus
C
Level of processing
M/Y
P/X
Retinal ganglion cells
Magnocellular layers 1,2
Parvocellular layers 3-6
Lateral geniculate nucleus
Form
Color
Area 17/VI
Area 17
Area 17
V1
Area 18 V2
Area 18 V3
Area 18 V2
Area 18 V2
V2/V3
Medial temporal V5
V4
V4
V4, MT
Posterior parietal cortex, area 7a
Inferior temporal cortex, area 37
Perception

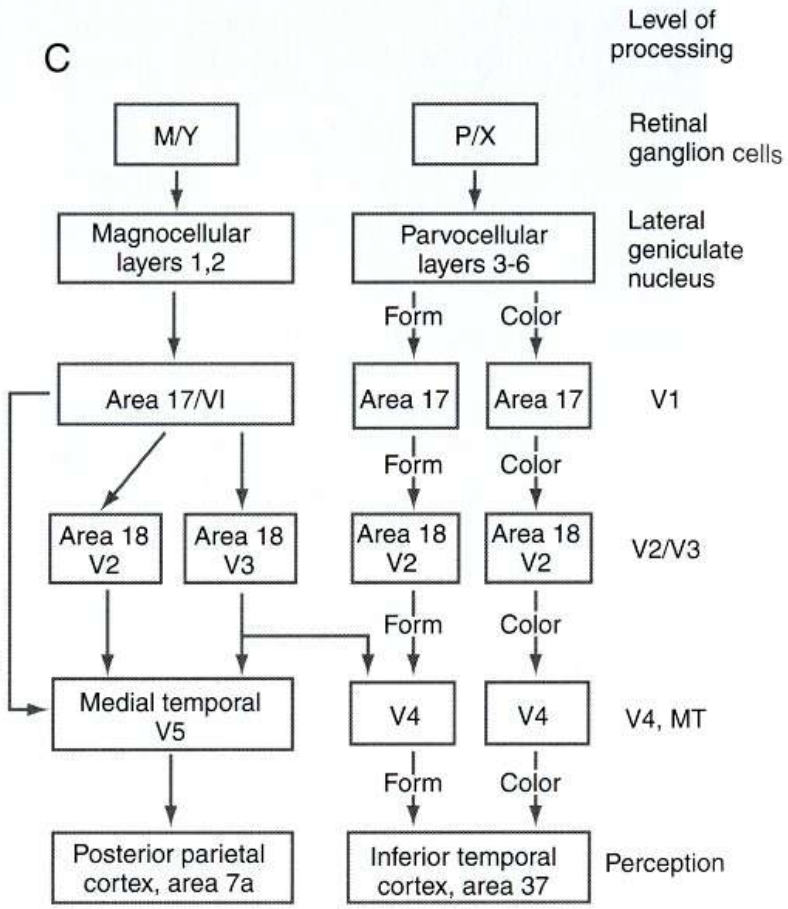
Dorsal "Where" pathway



Ventral "What" pathway

= Area 37

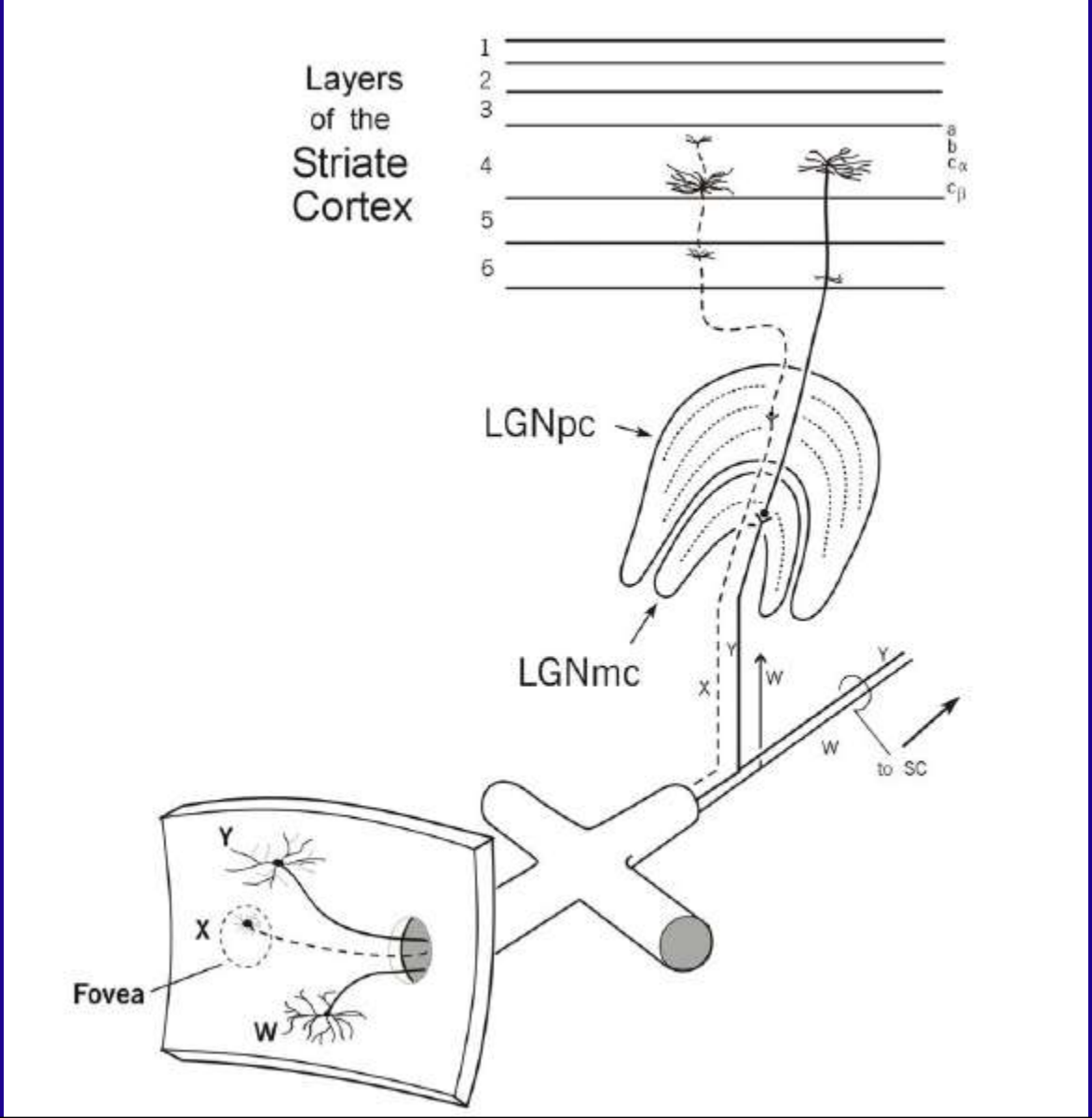


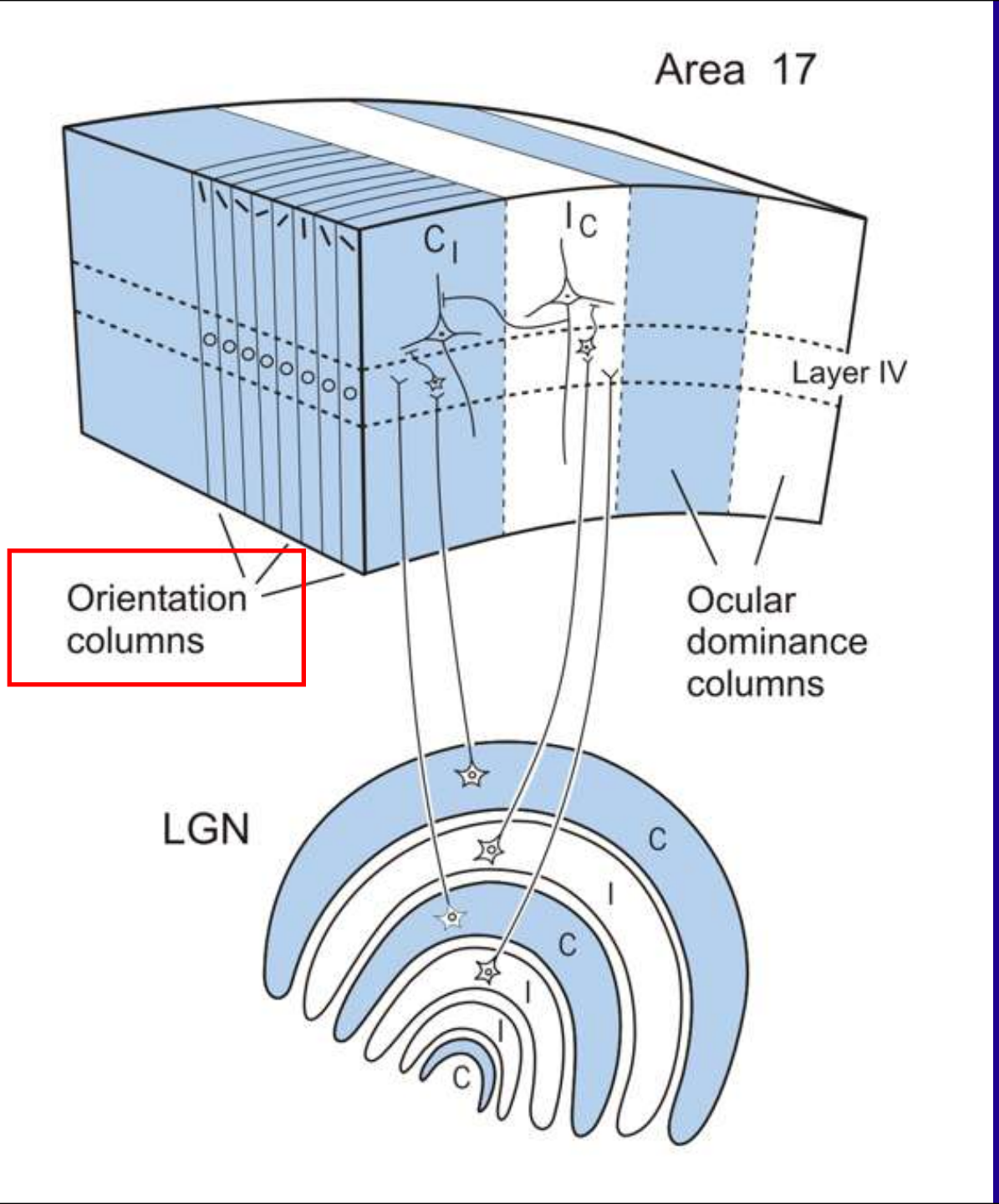


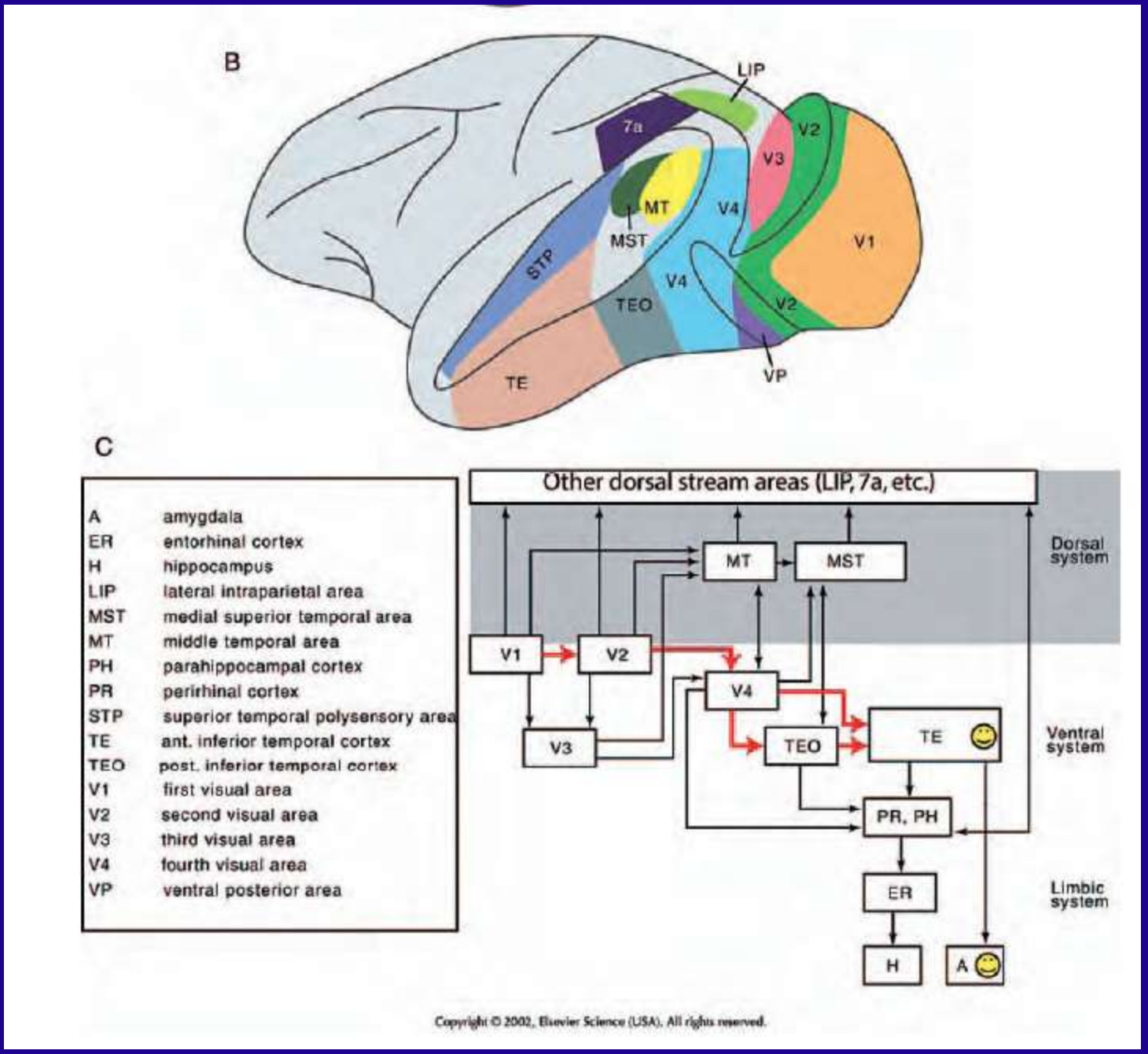
Cortical processing

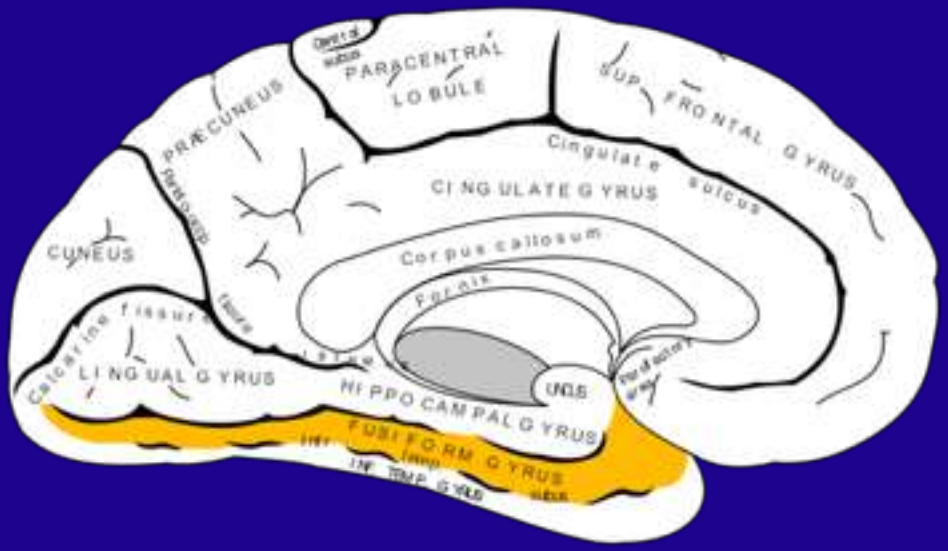
Visual processing as example

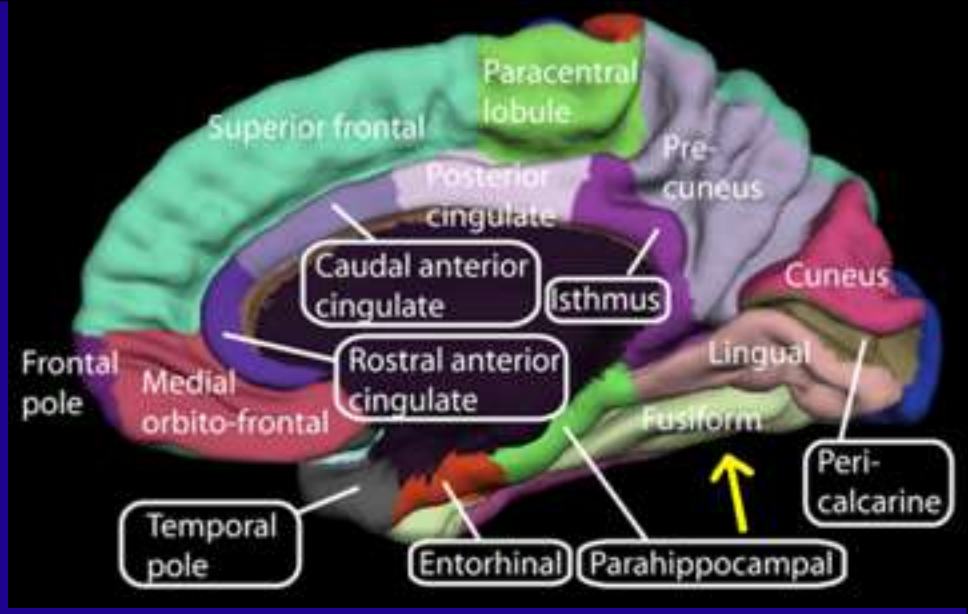
Primary visual cortex

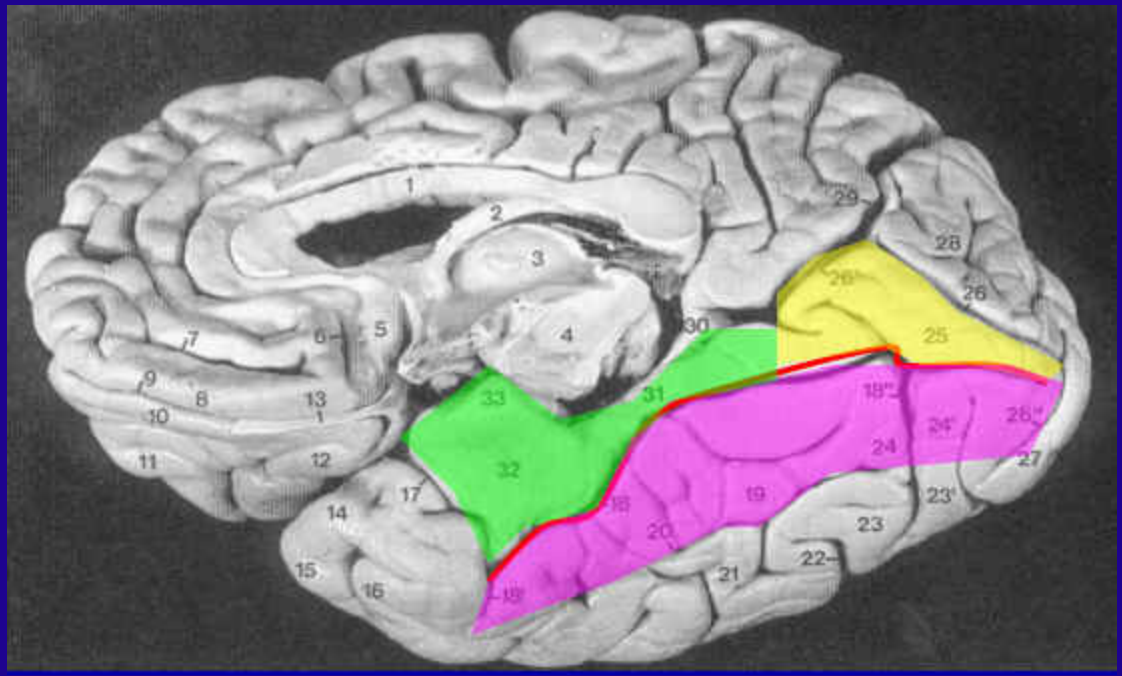



Area 17
C I
I C
Layer IV
Orientation columns
Ocular dominance columns
LGN
C
I
C
I
I
C




PARACENTRAL LOBULE
SUP. FRONTAL GYRUS
PRÆCUNEUS
Cingulate sulcus
CINGULATE GYRUS
Corpus callosum
Fornix
CUNEUS
Calcarine fissure
LINGUAL GYRUS
HIPPOCAMPAL GYRUS
UNCUS
FUSIFORM GYRUS


Superior frontal
Paracentral lobule
Pre-cuneus
Posterior cingulate
Caudal anterior cingulate
Isthmus
Cuneus
Frontal pole
Medial orbito-frontal
Rostral anterior cingulate
Lingual
Fusiform
Peri-calcarine
Temporal pole
Entorhinal
Parahippocampal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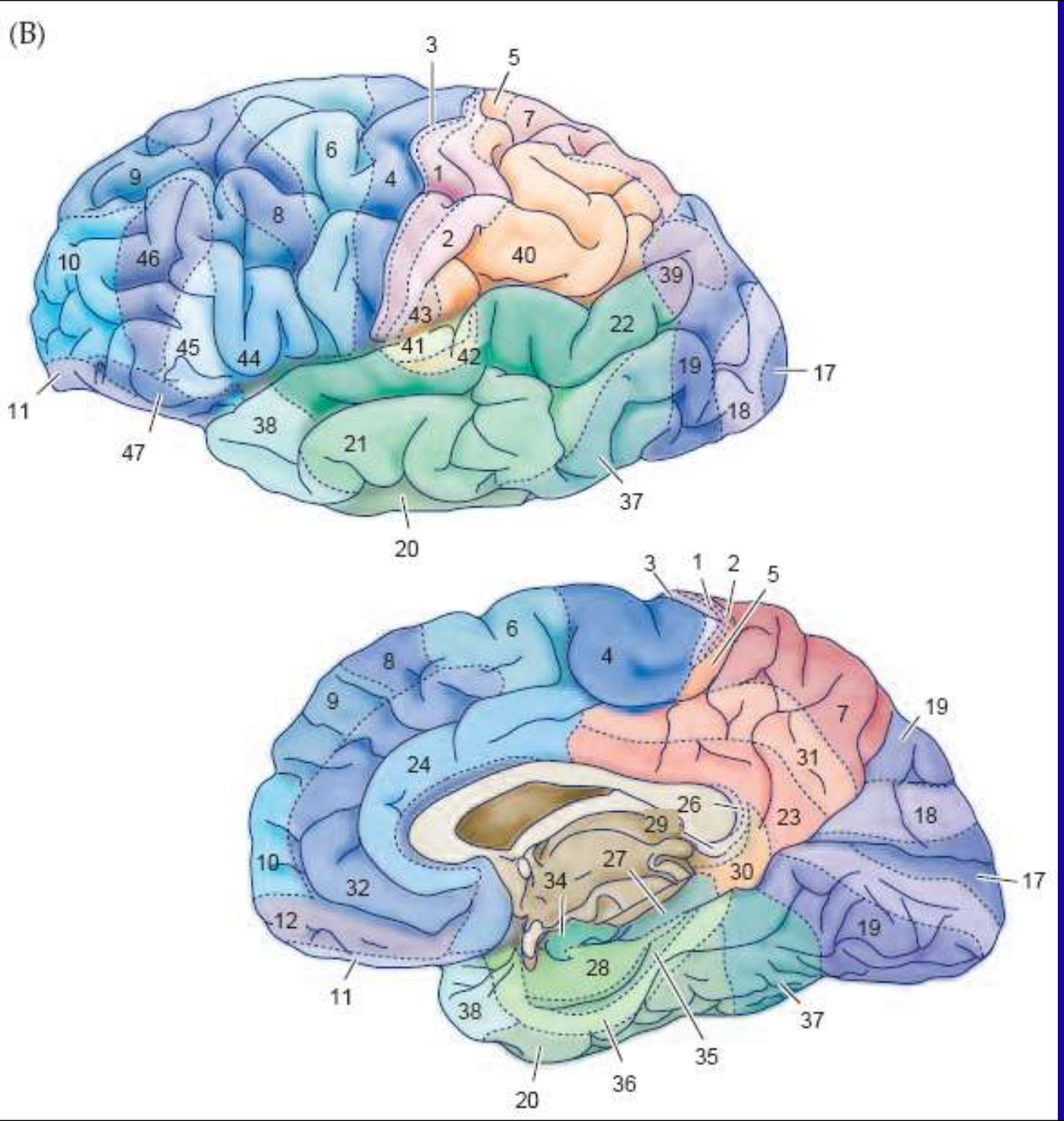
33


(B)
3
5
7
6
9
4
1
8
2
40
10
46
39
43
22
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41
42
44
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17
11
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38
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37
20
3
1
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27
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17
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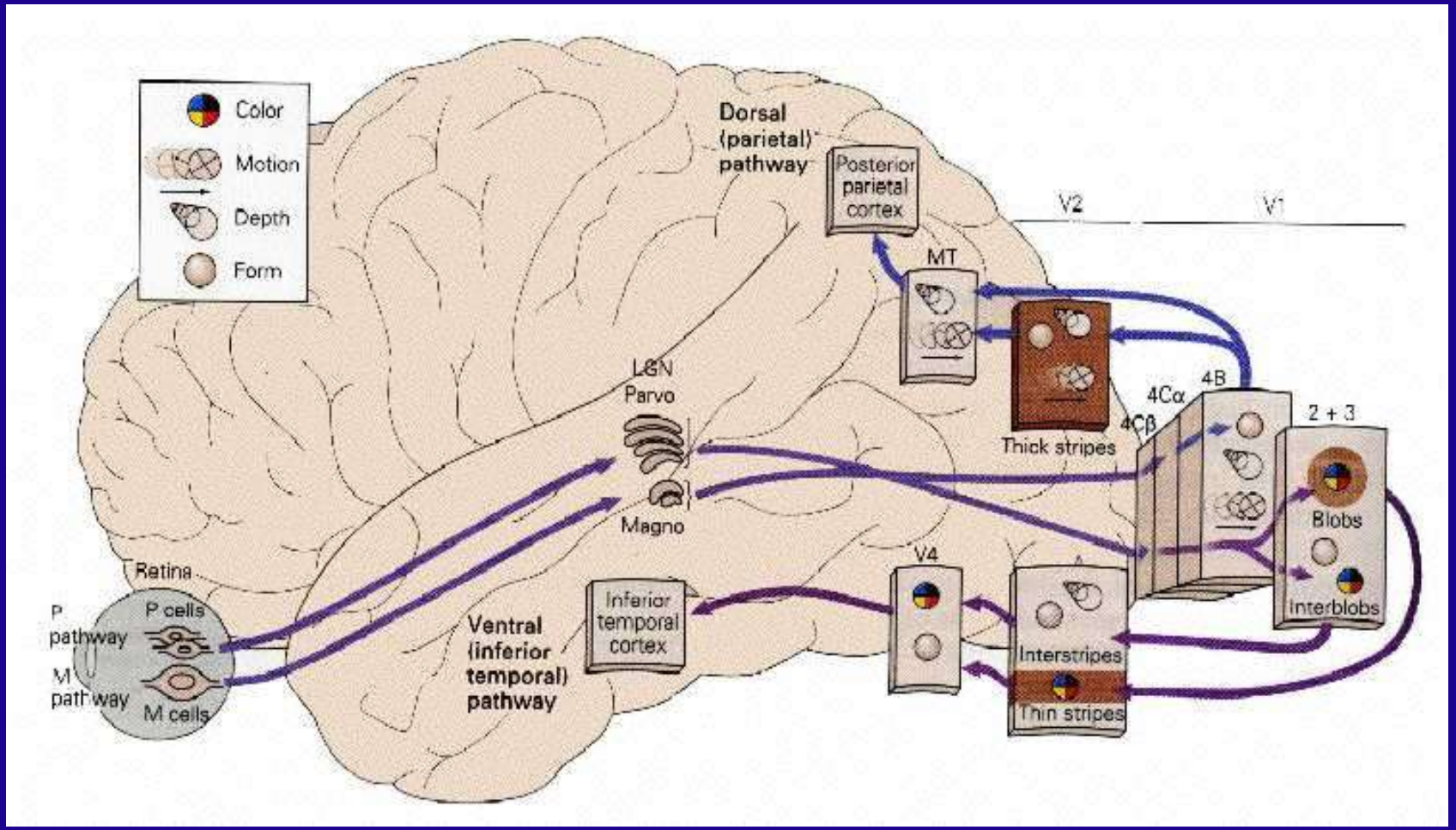
37
35
36
20

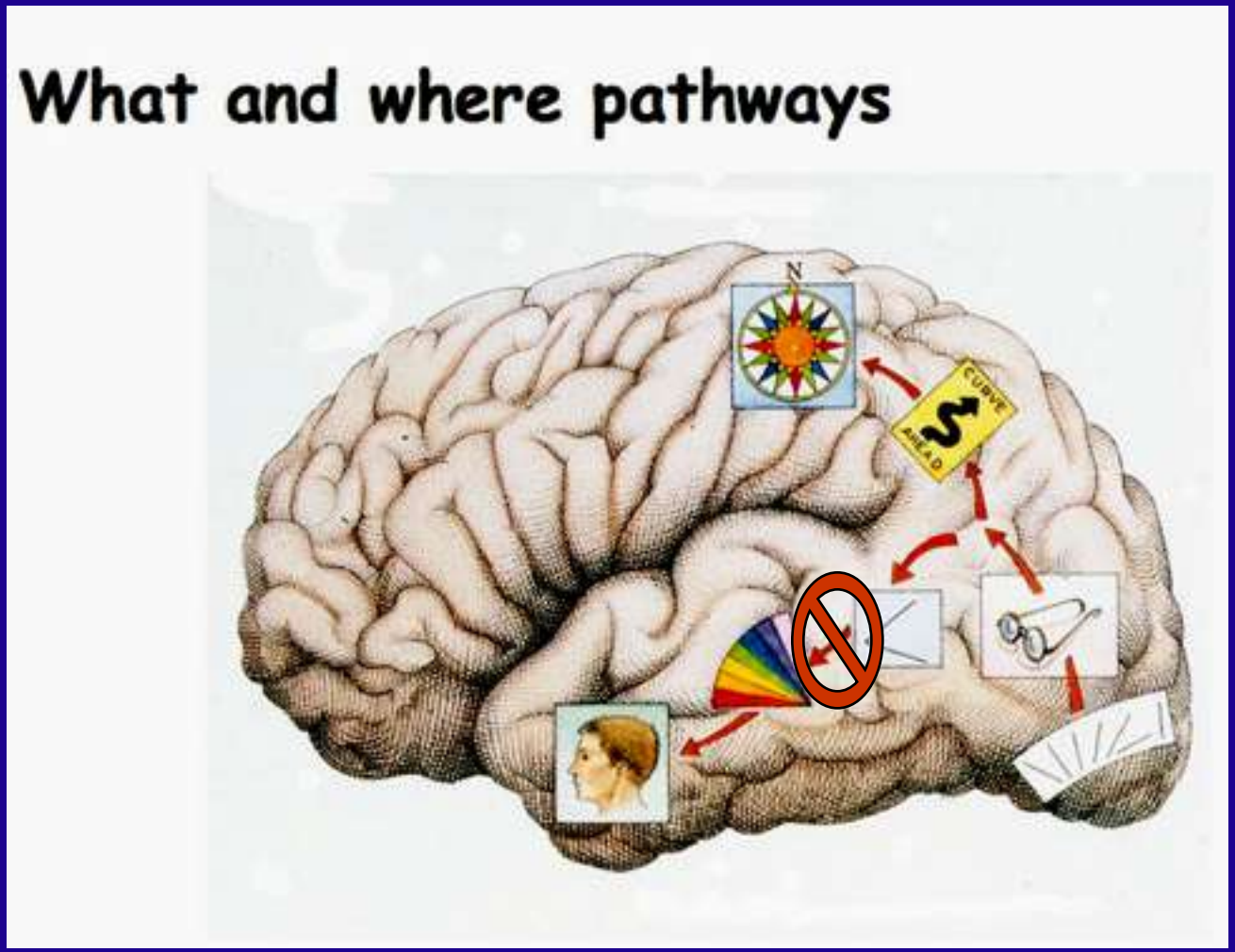
Visual processing of information

Damage to V1

- Blindsight
- Visual hallucination

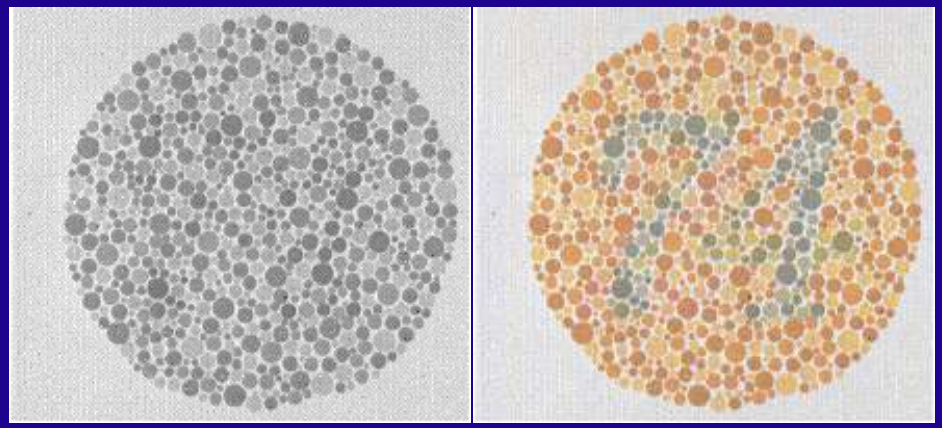

Color
Motion
Depth
Form
Dorsal (parietal) pathway
Posterior parietal cortex
V2
V1
MT
LGN
Parvo
Magno
Thick stripes
4Cα
4B
4Cβ
2 + 3
Blobs
Interblobs
Retina
P pathway
M pathway
P cells
M cells
Ventral (inferior temporal) pathway
Inferior temporal cortex
V4
Interstripes
Thin stripes

Damage to “What” pathway



Achromatopsia, agnosia

Achromatopsia



- **Complete achromatopsia-** BL area V4: Lingual/fusiform gyri/ occipitotemporal junction

Color agnosia & **Color anomia**

- loss the ability to retrieve color knowledge
- cannot name colors for objects but can sort

- Cant /Remembering the color of object “even by none verbal way” , like painting pumpkin orange or apple red
- Inability to name colors or to point to colors given their names, which is not due to aphasia or due to defective color perception

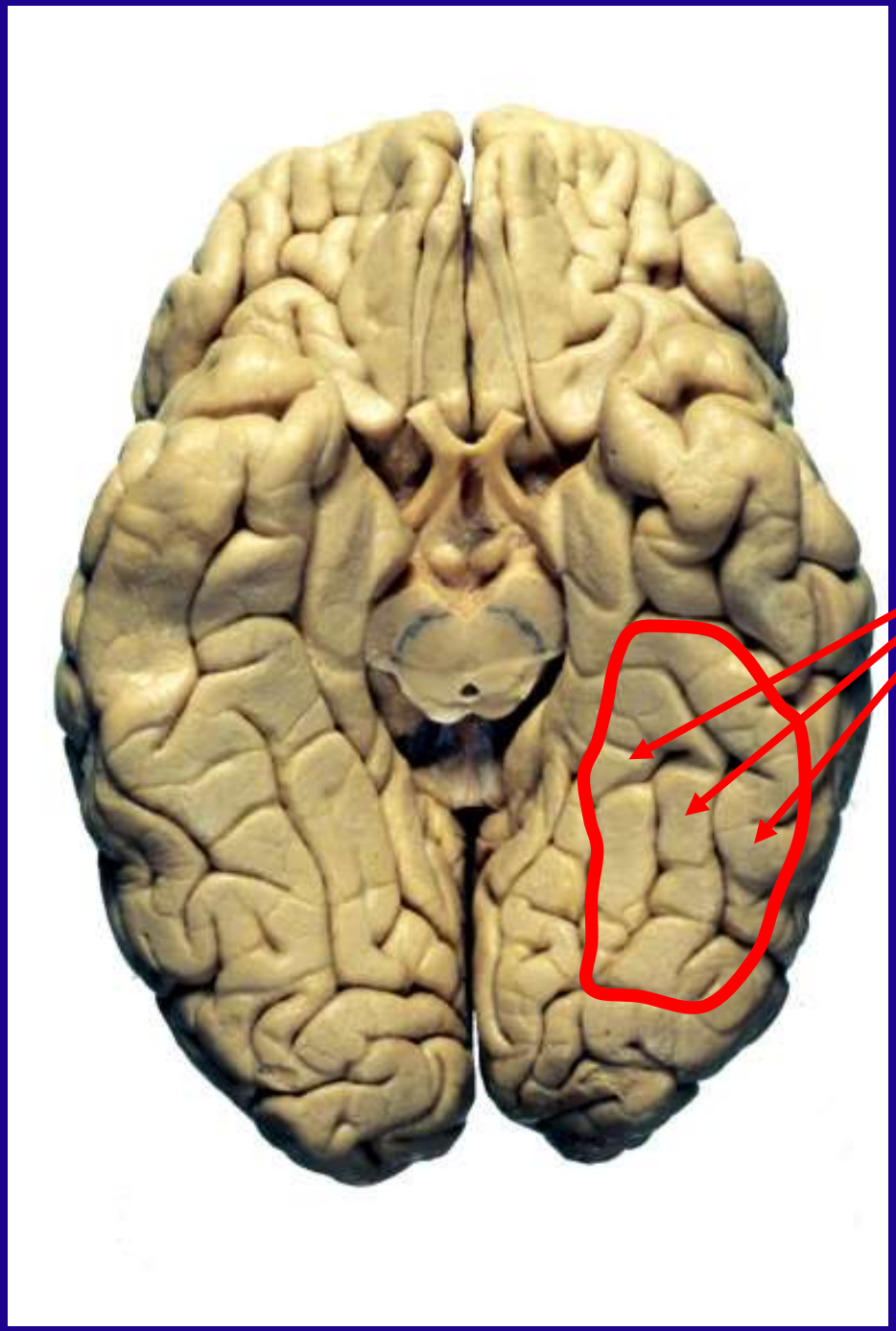
Left or bilateral occipitotemporal region & Inferior temporal

The Neural Basis of Visual Perception

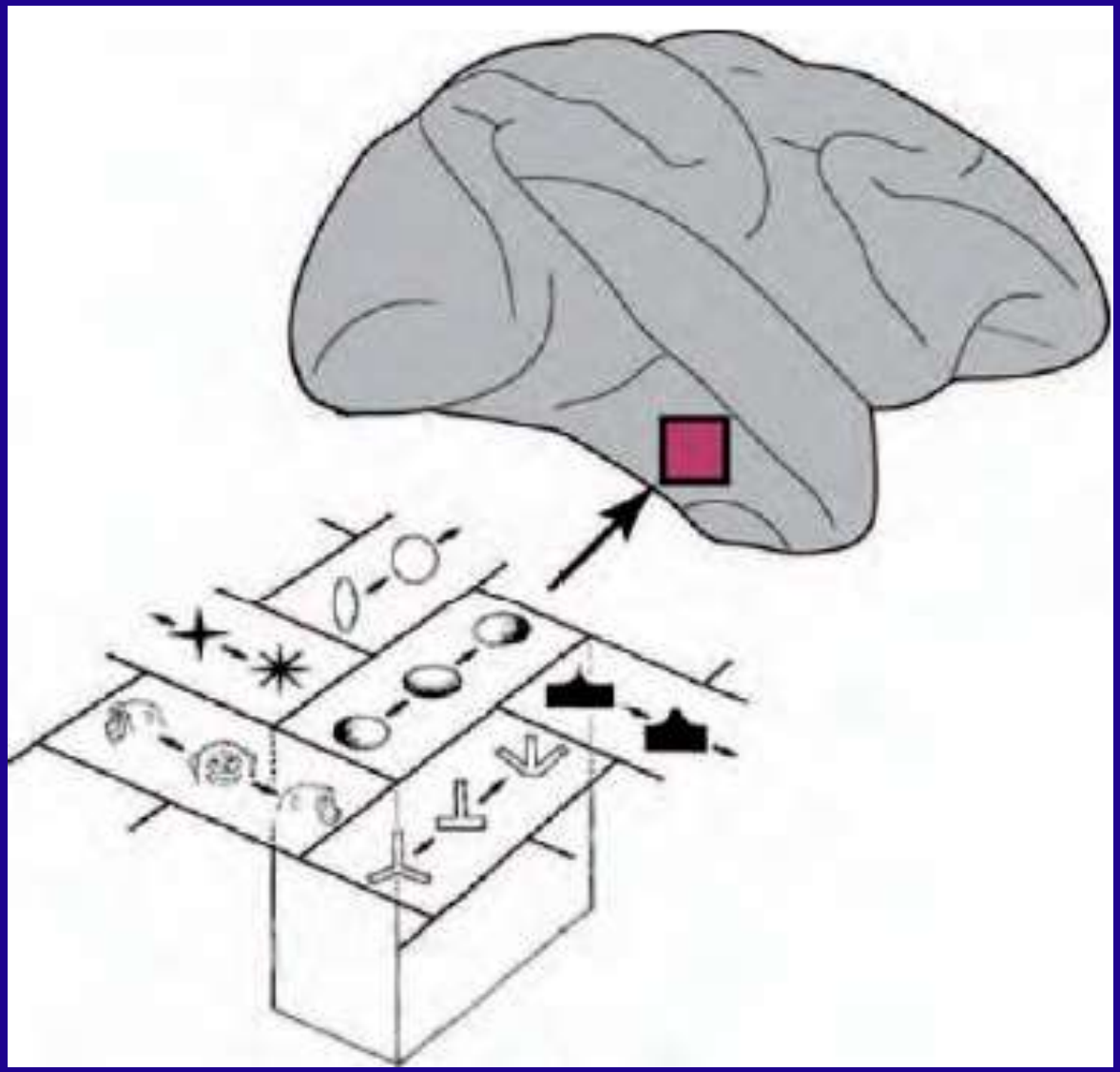
- Visual agnosia is the inability to recognize objects despite satisfactory vision.
  - Caused by damage to the pattern pathway usually in the temporal cortex.
  - For words : Alexia

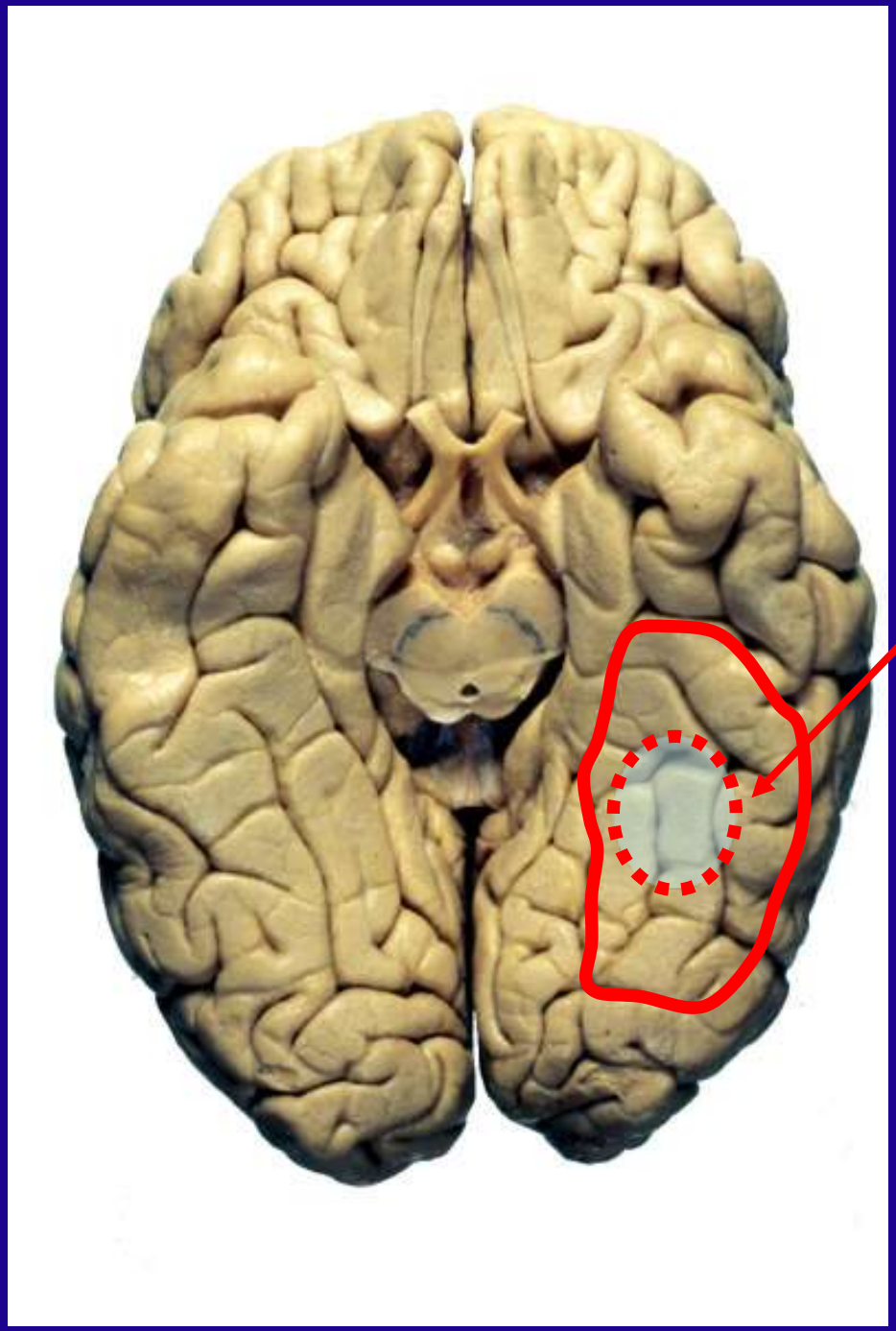
Agnosia

- Topographagnosia
  - Inability to navigate routes using familiar landmarks - deficit in familiar scene perception
  - **Right lingual gyrus**
- Alexia
  - **Left** (dominant lobe) fusiform/lingual areas



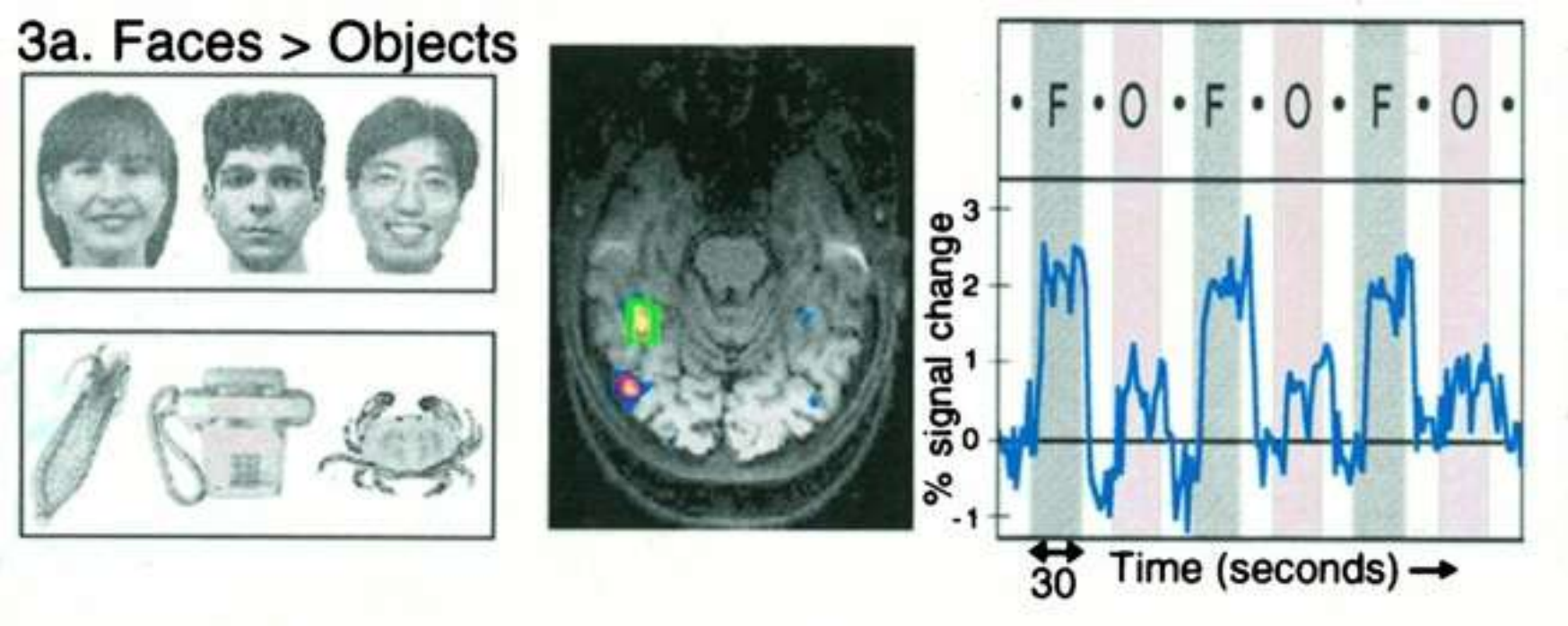
Occipitotemporal gyri



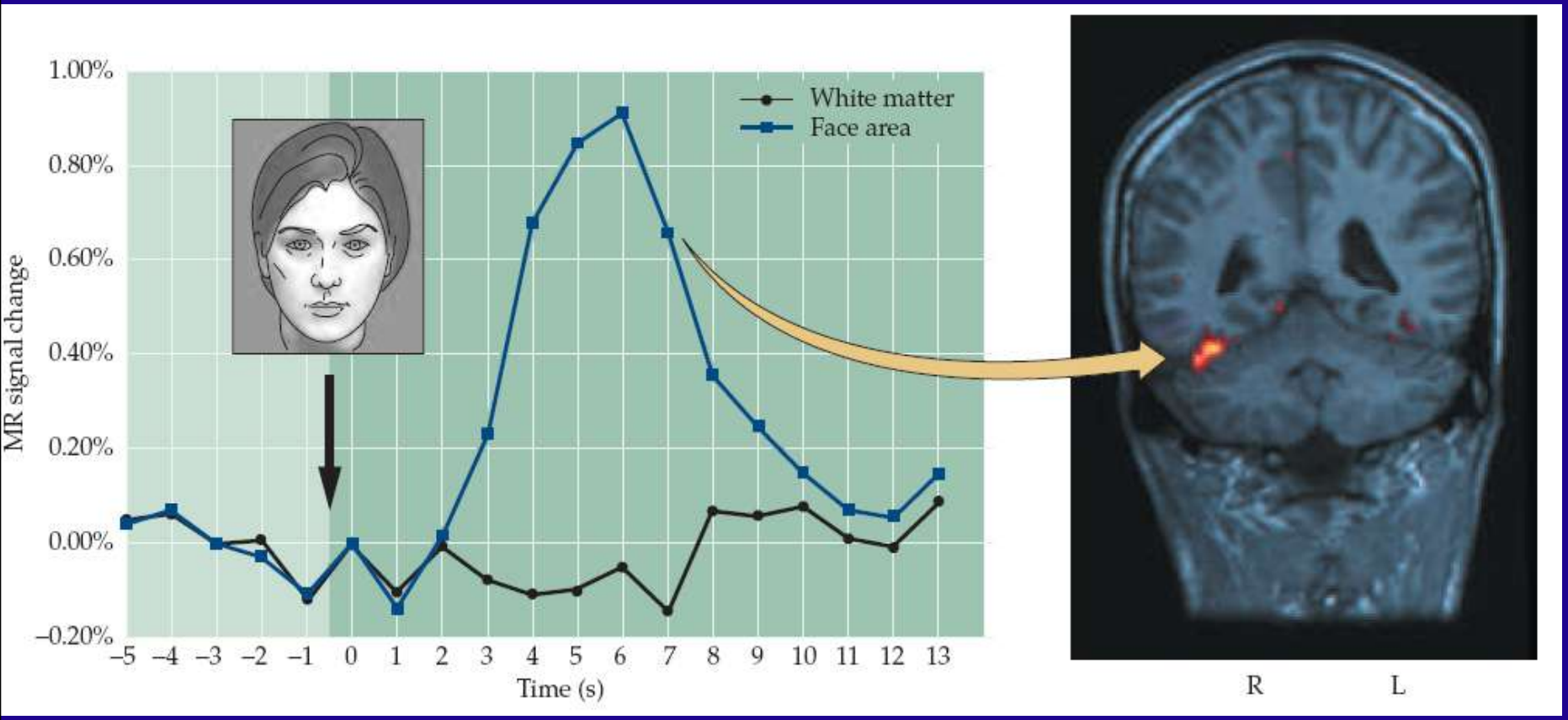


Middle Occipitotemporal gyri

Middle Occipitotemporal gyri



Kanwisher , McDermott, and Chun, 1997


1.00%
0.80%
0.60%
0.40%
0.20%
0.00%
–0.20%
MR signal change
White matter
Face area
–5 –4 –3 –2 –1 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Time (s)
R
L

Agnosia

- Prosopagnosia-
  - Inability to recognize or learn faces
  - Identify people by other cues- gait, mannerisms or facial features- spectacles, gait
  - Aware of defect
  - **BL medial occipitotemporal cortex**.